INFLATION MEASUREMENT AND ITS IMPLICATIONS FOR MONETARY POLICY IN SELECTED SEACEN ECONOMIES

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The SEACEN Centre

The South East Asian Central Banks (SEACEN) Research and Training Centre
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FOREWORD

The credibility of a central bank is closely tied to its ability to manage inflation effectively. The recent global rise in inflation following the COVID-19 pandemic has highlighted the vital role that central banks play in controlling inflation. Successful monetary policy implementation relies on accurately measuring the target inflation rate and understanding the theoretical foundations and limitations of the index used.

In the SEACEN region, central banks face unique challenges in monetary policy implementation due to the dominance of food items in the Consumer Price Index (CPI) as well as the region's vulnerability to volatile relative price changes. These changes are often driven by external factors such as global commodity prices, exchange rates, and trade flows. This complexity can make monetary policy more challenging, as inflation may stem from specific sectors rather than reflecting broader economic pressures.

This study aims to address the gap in understanding the relationship between inflation measurement and its implications for monetary policy. First, it discusses the essential components of compiling the Consumer Price Index (CPI) through case studies of eight SEACEN member economies. This includes the weights and composition of the CPI basket, the methodology used to calculate the index, and the data collection process. Second, the study analyses how changes in relative prices affect the implementation of monetary policy.

The project team included representatives from the following central banks: Brunei Darussalam Central Bank, Reserve Bank of India, Bank of Korea, Bank of the Lao PDR, Bank Negara Malaysia, Bank of Mongolia, Nepal Rastra Bank, and the Central Bank of Sri Lanka. The SEACEN Centre would like to express its sincere gratitude to all the team members and the participating central banks for their contributions and support for this project.

The project was led by Dr. Rajan Krishna Panta, Director, Nepal Rastra Bank, who was appointed Visiting Research Economist at The SEACEN Centre (SEACEN) in 2023. We extend our sincere gratitude to Dr. Ole Rummel, Director of Macroeconomic and Monetary Policy Management (MMPM), SEACEN, for his overall guidance and leadership throughout the project. We also gratefully acknowledge the valuable feedback from SEACEN MMPM staff members, particularly Dr. Rogelio Mercado and Dr. Meltem Chadwick.

The SEACEN Centre is pleased to have contributed to the project through an online research workshop and an in-person seminar held at its premises, where the project's findings were presented and discussed. I sincerely hope that this study will deepen our understanding of inflation measurement processes and aid in developing a more nuanced approach to implementing monetary policy.

Dr. Cynyoung Park
Executive Director
The SEACEN Centre

SUMMARY

Successfully implementing monetary policy depends significantly on an appropriate framework for measuring the target inflation rate. In most countries, central statistical or government agencies are responsible for compiling and disseminating inflation data. However, central banks often lack a comprehensive understanding of the conceptual basis and methodologies involved in this process, which has impeded a detailed analysis of how inflation figures influence monetary policy. This study highlights the main challenges involved in measuring the Consumer Price Index (CPI) and provides an overview of how the eight SEACEN member economies that participated in this study, compile their CPIs. Although the compilation methodologies adhere to internationally recognised best practices, there are significant differences in terms of coverage, computation methods, the weight assigned to items in the CPI basket, and various inflation aggregates. A more detailed analysis of inflation trends indicates that inflation is driven by a limited set of prices rather than by widespread movements across the economy. It has been observed that food inflation is generally higher than inflation for non-food items and services in most countries over the medium- to long- term. In addition to direct effects, this narrow range of items can influence overall inflation through second-round effects on the prices of other goods and services, which arise from increased costs and inflation expectations. The findings from various country case studies highlight the advantages of analysing inflation at a more disaggregated level, rather than solely focusing on headline or core inflation figures. Furthermore, measuring inflation is a complex task, as calculating the index relies on both theoretical frameworks and practical data collection issues. This underscores the importance of flexibility in pursuing inflation targets, rather than depending on a single measure alone.

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Inflation Measurement and Its Implications for Monetary Policy in Selected SEACEN Economies

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This research publication, prepared by The SEACEN Centre, does not necessarily reflect the views and policies of the SEACEN member central banks and monetary authorities.

Notes:

- The SEACEN Centre recognises "China" as People's Republic of China; "Hong Kong" as Hong Kong SAR, China; and "Korea" as Republic of Korea.
- USD and US$ refer to U.S. dollar.

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CHAPTER 1

INTEGRATIVE REPORT: INFLATION MEASUREMENT AND ITS IMPLICATIONS FOR MONETARY POLICY IN SELECTED SEACEN ECONOMIES

By
Rajan Krishna Panta, PhD[1]

1. Background

Controlling or keeping inflation at a low and stable level is one of the major objectives of central banks. The credibility of almost all central banks is gauged in terms of inflation performance (Bordo & Siklos, 2015). The SEACEN member economies have made significant progress towards taming inflation over the last two decades. Among the South East Asian Central Banks (SEACEN) member economies, six have adopted flexible inflation targeting while several others have oriented themselves towards the regime (IMF, 2021).[2] The successful implementation of monetary policy hinges on the precise measurement of the goal variable, the target inflation rate and the ability to forecast inflation as the transmission mechanism takes place with a lag (Orphanides & Wieland, 2008). Moreover, "the choice of a suitable framework for measuring inflation is a key element of any price stability-oriented monetary policy strategy" (European Central Bank, 2021).

Inflation is often quantified by the percentage change in the Consumer Price Index (CPI), which represents the average price of goods and services consumed by a representative consumer/household in the country. Hence, the accurate measurement of inflation is of utmost importance for central banks (Federal Reserve Bank of San Francisco, 2004). Ideally, accurate measurement of inflation hinges on the following characteristics: (1) Timely availability of quality and reliable data on the CPI and its components to understand the evolution of different sub-categories of prices (e.g., domestic price trends versus imported prices), (2) A robust and reliable quantitative analyses of inflation to provide metrics for policy interventions and design, and (3) Linking and evaluating the data, quantitative models and policy through the conduct of monetary policy and overall macroeconomic stance (Johnson, 1999).

1. Director, Nepal Rastra Bank.

2. The SEACEN Centre was established as a legal entity in 1982 with eight member Central Banks. Its membership has grown to 19 member Central Banks/Monetary Authorities. According to the IMF classification Philippines, India, Indonesia, Korea, Sri Lanka and Thailand have Inflation-targeting as their monetary policy framework (IMF, 2021).

The compilation and computation of CPI is challenging for both theoretical and practical reasons. It involves a number of choices regarding the selection of goods and services in the basket, assigning weights, selection of price collecting outlets/sample points, and several methodological issues such as consumption versus expenditure approach, sources, and formulas to calculate weights and commodity coverage, among others. It is further complicated by frequently changing expenditure patterns resulting in substitution bias, new outlet bias, introduction of new goods or services and change in quality of the goods and services among others (IMF, 2017). Although most SEACEN economies rely on periodic Household Expenditure Surveys conducted by their respective national statistics office to select the goods and services and their weights in the CPI, some economies leverage on comprehensive Living Standard Measurement Surveys.[3]

There have been international efforts to harmonise and implement good practices from survey design to computation of price indices to facilitate international comparison of inflation data. The Consumer Price Index Manual (2020), endorsed by the 51st meeting of the United Nations Statistical Commission (UNSC) in March 2020, provides comprehensive compilation methods and data sources on CPI (IMF; ILO; Eurostat; United Nations; OECD; World Bank Group, 2020). However, significant disparities exist among countries regarding the quality of CPI statistics, and there are many opportunities to modernise the collection of prices (Vanda, Baer, & Silungwe, 2022).

In addition, the IMF's Data Quality Assessment Framework (DQAF) outlines different aspects of CPI computation, including data collection, processing, and dissemination (IMF, 2012). The main objective of the Framework is to offer a flexible structure for the qualitative assessment of consumer price index statistics. Within this framework, SEACEN member economies also provide information on various quality aspects, including assurances of integrity, methodological soundness, accuracy and reliability, serviceability, and accessibility. However, "a major point of concern is the lack of information publicly available on the sources and methods used to compile the CPI" which have hindered the detailed analysis and cross-country comparison of inflation measurement and its impact on monetary policy (Vanda, Baer, & Silungwe, 2022).

Headline inflation is often used as the target of monetary policy because it is easily understood by the public. For example, it is used by central banks like the Bangko Sentral ng Pilipinas, Reserve Bank of India, and Bank Indonesia. In addition to headline inflation, other inflation indicators such as core inflation and different versions of the CPI, based on its composition and geographical coverage, are computed for specific purposes. Core

3. Vietnam, for example, uses the Vietnam Household Living Standard Survey (VHLSS) to select the items and derive the weights in the CPI basket (https://www.gso.gov.vn/en/metadata/2019/03/explanation-of-terminology-content-and-methodology-of-some-statistical-indicators-price/). Similarly, Nepal Rastra Bank in coordination with the National Statistics Office, has used the Nepal Living Standard Survey (4th Round) for the first time since the computation of CPI more than five decades ago instead of conducting another separate Household Budget Survey by itself to avoid duplication of resources and potential conflict of interest.

inflation is calculated by excluding food and energy prices, excise duties, income tax, etc. One argument for excluding these prices is the assumption that they can be quickly reversed and do not require a monetary policy response (Motley, 1997). Similarly, CPI inflation is also disaggregated, for example, as Volatile Food Inflation and Administered Price Inflation in Indonesia and CPI excluding Agricultural Products and Oils in Korea (Bank of Korea, n.d.; Bank Indonesia, n.d.).

These various inflation indicators, along with the inflation differences in geographic regions, can provide valuable information about the potential differential impact of monetary policy responses across sectors and regions in an economy (Caralino & Defina, 1998; M, Ray, & Ghosh, 2002).[4] The asymmetric transmission of monetary policy across regions and industries can be explained by the varying firm-level characteristics. These include differences in interest rate sensitivity, firm size, capacity of financial institutions to adjust their balance sheets, and the level of financial development (Nachane, Ray, & Ghosh, 2002; Caralino & Defina, 1998).

Furthermore, not all prices change at the same pace or in the same direction. Recent observations show that price movements in certain sectors or commodities have been driving overall inflation (Claudio, Piti, Dora, & Zakrajšek, 2021). As a result, a single measure of inflation often hides the changes in relative prices. Therefore, monetary policy actions tend to impact a narrow set of prices, which limits their effectiveness in controlling inflation and the rationale behind taking those actions (Claudio, Piti, Dora, & Zakrajšek, 2021). It is crucial to understand the sources and variations in spatial inflation rates to effectively implement monetary policy, as opposed to the prevailing paradigm of uniform and undifferentiated effects of such actions.

The impact of COVID-19 has brought to the fore the complex task of central banks in dissecting and understanding the different drivers of inflation and interplay between inflation and supply chain costs which were largely ignored in previous analyses. The onset of COVID-19 has added fresh challenges to traditional field collected data, making it less reliable, particularly due to rapid changes in consumer and business behaviour (ILO et al., 2020). However, the crisis has also provided a tremendous impetus to leverage on the digital technology to use alternative data sources to collect consumer prices (ILO et al., 2020). The soaring inflation that ensued due partly to pandemic stimulus coupled with the Russia-Ukraine conflict, has prompted unprecedented policy responses by monetary authorities to rein in inflation with limited understanding of the nature of inflation drivers/ data and its interaction with the post-COVID recovery cycle.

4. Vietnam, for example calculates the Spatial Cost of Living Index (SCOLI) indicator which reflects the tendency and change of cost of living among regions, provinces within a certain period (https://www.gso.gov.vn/en/metadata/2019/03/explanation-of-terminology-content-and-methodology-of-some-statistical-indicators-price/).

2. Objectives

This report will discuss the nuts and bolts of the compilation and computation of CPI by selected SEACEN member economies. It will also discuss the innovative approaches to survey and data collection. The analysis will be linked to the effective implementation of monetary policy in challenging times. While the earlier research by SEACEN has focused on the modeling and forecasting of inflation, this research study will endeavour to fill the glaring gap on publicly available information on the compilation and computation of CPI (Finck & Tillmann, 2019). The study will also contribute towards sharing of knowledge and experiences among the SEACEN member economies to distill good practices in data collection and computation of price indices during the pandemic.

The purpose of the research is to share experiences and exchange best practices on the measurement and computation of CPI for the effective design and implementation of monetary policy. The specific objectives of the research are:

1. To better understand the survey and computation methodologies of inflation among the selected SEACEN member economies.

2. Share experiences regarding the adjustment of CPI related to missing observation, change in quality of products and services, seasonality, etc.

3. Identify and evaluate innovative data collection approaches and methods to ensure consistency over time and comparability across countries.

4. To examine the usefulness of various inflation indicators to facilitate monetary policy formulation and implementation.

The case studies from selected SEACEN economies cover various aspects of survey methodology and computation of CPI such as:

- the steps of price index compilation consisting of its purpose and links with national accounts,

- resources (human and software),

- technical weights assigned and its accuracy and regularity of updating,

- collection of data on price changes (matched model, sampling of representative items, selection of representative geographical and outlets etc.),

- issues regarding price collection such as sample maintenance, periodicity, quality assurance, treatment of missing prices (temporarily and permanently missing prices, quality-adjustment, seasonal items, introduction of new products etc.),

- hard-to-measure goods and services (e.g., shelter, telecommunications, health, computers etc.),
- formulas to compute index (e.g., higher-level aggregation, chaining and linking/ rebasing, lower-level aggregation formulas and justification of choice of formula),
- novel approaches in data collection, and
- dissemination strategies.

It also discusses the various inflation measures computed by these economies and its implications for monetary policy.

3. Outline of the Report

This integrative chapter provides the background and objectives of the study. It then briefly discusses the major issues involved in the measurement of the CPI. It also presents stylised facts about the selected countries and an overview of the major CPI compilation practices. Finally, it discusses the implication of CPI measurement for monetary policy implementation. The rest of the chapters are devoted to the country cases.

Chapter 2 provides the case study of Brunei Darussalam. The chapter discusses the CPI compilation process in Brunei Darussalam along with evolution of inflation rate.The weights for the current CPI series are derived from the Household Expenditure Survey conducted in 2015/2016. The food and beverages group occupies around 19% of the weight, reflecting its high-income country status. Prices are collected from all four districts through field visits, telephone calls and websites. A notable feature is the substantial government price controls and currency board arrangement with Singapore which has helped to keep inflation historically at low levels.

Chapter 3 presents India's case study. The Reserve Bank of India (RBI) has adopted CPI as a key measure of inflation since 2013, marking the transition from wholesale to the retail price indices. Prior to the availability of CPI at a combined level, retail price indices were available on a sectoral basis (for industrial workers, agricultural labourers, rural labourers and urban non-manual employees), besides the all-India WPI. The chapter discusses price collection for publicly distributed items and treatment for missing items. The baskets and weights vary among these different variants of CPI. The study also highlights the sectoral, spatial and rural-urban divergences in inflation. The study empiricaly examines the inflation persistence across states and the interaction between the core, non-core and headline inflation. The effectiveness of flexbile inflation targeting regime is also analysed in terms of anchoring inflation expectations.

Chapter 4 discusses briefly the CPI compilation practices in South Korea. Prices are collected of 458 items from 40 major cities across the country. The current weights and basket for the CPI is based on the Household Trends Survey 2022, with the price reference

period being 2023. The highest weight is occupied by housing, utilities and fuel followed by food and beverages. The study also briefly discusses the data collection and verification process to ensure the accuracy of the price data. Bank of Korea targets the headline inflation instead of core inflation despite the share of food items is low compared to other countries.

Chapter 5 presents the case study of Lao PDR. It discusses the CPI compilation methodology based on the Lao Expenditure and Consumption Survey V, with the base year being 2015. The study also analyses the key drivers of inflation and areas for further improvements in the compilation of CPI. It also briefly discusses the recent monetary policy response to the soaring inflation after the COVID-19 pandemic.

Chapter 6 presents the case study of Malaysia. It analyses the CPI compilation practices, presenting the details of the Household Expenditure Survey of 2022, which is the latest base of the index. It highlights the challenges associated with fluctuating prices especially during the festive seasons, extensive price controls and high imports share in the CPI. The study also analyses the divergent impact of higher prices across different income groups. It analyses the inflation dynamics and the interaction between the core and headline inflation. The study also examines the impact and policy responses to the surge in inflation in the aftermath of COVID-19.

Chapter 7 presents the case study of Mongolia. The study documents the CPI compilation process and analyses the key components of inflation drivers. Due to high inflation volatility and changing consumption patterns, the chained index method is used to compute the CPI. The study also empirically examines the impact of external shocks and exchange rate fluctuations on inflation using the Bayesian Vector Autoregression (BVAR) method.

Chapter 8 presents the case study of Nepal. It discusses the historical evolution of inflation measurement in Nepal. The weights and baskets for the CPI were derived from the Household Budget Surveys until the recent rebasing in 2023, which utilises the Nepal Living Standard IV Survey results. The methodology and the price collection process and adjustment for prices are also discussed. Given the pegged exchange rate, restrictions on capital flows and high trade dependence with India, the study offers fresh empirical evidence on the pass-through of various sub-groups of food and non-food inflation to Nepal's inflation.

Chapter 9 dicusses the case study of Sri Lanka. Although the Department of Census and Statistics compile various consumer price indices based on regional coverage and socio-economic groups, the longest-standing is the Colombo CPI for which both headline and core CPIs are computed. The national CPI (NCPI) was introduced recently in 2015. The study also documents in detail, the CPI compilation methodology of different versions of CPI. It also analyses the recent episodes of high inflation and major drivers of inflation.

4. Literature Review: Major Issues in the Measurement of Consumer Price Index

This section aims to provide an overview of the major issues involved in the compilation and computation of CPI. It is not intended to delve into a comprehensive review on the technical aspects for which there already exist a detailed manual prepared by a consortium of international agencies along with the separate technical guide (ILO et al., 2020). Rather, it aims to highlight the crucial link between the compilation of CPI and the implementation of monetary policy.

The history of the compilation of consumer price index dates back to more than a hundred years.[5] The precursor of the modern CPI are various types of price indices compiled by most countries in the wake of World War I for wage negotiation purposes[6] (United States Department of Labour, 1966). Accordingly, consumer price indices for specific groups of workers are being compiled even today.

There are two competing conceptual bases regarding the measurement of CPI – the Cost of Goods Index (COGI) and the Cost of Living Index (COLI). The choice of these approaches has important implications for the purpose and methodology on the construction of the index (Reinsdorf & Triplett, 1970; Stoevska, 2006). The Cost of Goods Index (COGI) approach attempts to measure the change in purchasing power of money over time while keeping the quantities and qualities of goods and services constant (European Central Bank, 2021; Reinsdorf & Triplett, 1970). Thus, the COGI approach seeks to measure the change in purchasing power of money over time to capture the pure price change while ignoring the substitution effects and quality change (Reinsdorf & Triplett, 1970; European Central Bank, 2021). In contrast, the COLI aims to measure the minimum expenditure required to maintain a certain standard of living, welfare or utility when facing two different set of prices (Osbat, et al., 2024; Reinsdorf & Triplett, 1970). Thus, the pure COLI includes all goods and services that affects an individual's welfare including public goods also referred to as 'unconditional COLI' in contrast to the 'conditional COLI' which excludes many or all non-market products This approach is based on consumer theory focusing on welfare analysis and often included in economic models and Dynamic Stochastic General Equilibrium Models (DSGE) in particular (Osbat, et al., 2024).

The COLI is hard to implement in practice as consumers frequently substitute goods and services due to changes in relative prices or income and hence, the consumption 'basket' hardly remains the same. The ideal index, therefore, requires the 'utility' derived from the consumption of the goods and services to remain constant or the consumption basket to be fixed. The distinction among the current fixed-weight Laspeyers type CPI, the constant-utility and fixed consumption baskets lie at the heart of the conceptual debate

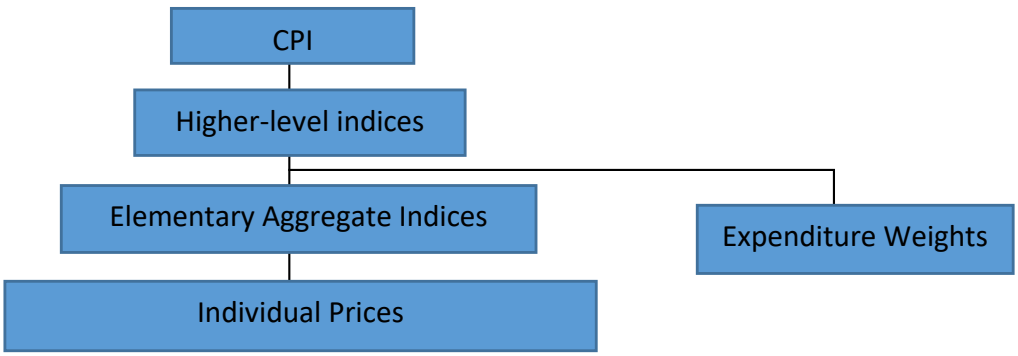
5. See (https://unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.22/2018/ILO.pdf)
6. See (https://unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.22/2018/ILO.pdf)

surrounding the measurement and purpose of these indices (Diewert, Greenlees, & Hulten, 2009). Moreover, complications arise to account for self-produced and consumed goods and services and those provided by the government (International Labour Organization/ International Monetary Fund/Organisation for Economic Co-operation and Development/ European Union/United Nations/The World Bank, 2020).

The current debate on the COGI versus COLI as a basis for inflation measurement is also highlighted in the seminal report by the US Senate Finance Committee appointed commission on improving inflation measurement, also referred to as the Boskin Commission (Boskin, Dulberger, Gordon, Griliches, & Jorgenson, 1996). The Commission argued that the CPI overestimated the true cost-of-living by 1.1 percent points annually and recommended that the Bureau of Labour Statistics (BLS) adopt measures to improve the CPI's accuracy, including better adjustments for substitution, quality improvements, and new products. The concept of COGI closely aligns with the Consumer Price Index (CPI), although COLI is the theoretical benchmark to measure inflation. In practice, most statistical agencies produce a CPI that lies between a COLI and COGI.

CPIs are, in general, computed in two stages: the first step, also known as the elementary aggregate indices, is the basic building block and is calculated based on the prices of individual products or services collected from outlets or other sources and is often unweighted (Chart 1). The second step comprises of the so-called higher-level indices and is calculated as the weighted averages, with expenditure shares of households as weights, of elementary aggregate indices. The expenditure shares are usually derived from the nationally representative household expenditure or budget surveys which should be periodically revised to reflect the changing consumption patterns and arrival and disappearances of some goods and services.

Chart 1: Aggregation Structure of CPI



Apart from the conceptual basis, methodological issues on the use of various index formulae for the computation of CPI is another source of debate. The choice of formula for the various stages of index aggregation is not trivial and can often yield significantly different results (Silver & Heravi, 2007; Gabor & Vermeulen, 2014). There are several formulae to compute the price indices at the elementary level, that is, the aggregate index of the prices of same or similar products collected from different outlets. Prominent among these are the so-called Carli, Dutot and Jevons Indices which differ based on the types of average (average prices vs price relatives) and arithmetic vs geometric mean (CPI manual). These formulae can produce considerably different indices depending on the price dispersion (Silver & Heravi, 2007).

The decision to adopt a particular formula can seriously induce bias in the inflation figure due to the cumulative effect over time. For example, the change of elementary index to ratio of geometric mean of prices by the Bureau of Labour Statistics in January 1999 effectively reduced the CPI by approximately 0.2 percentage point annually which had huge implications for adjustment of social security benefits (Ibid, 2006). The superiority or the recommendation on the use of particular formula depends on the relative importance of two major approaches, namely the *economic approach* which focuses on the economic interpretation of the index or the *axiomatic* or *test approach* that stresses the desirable statistical properties of particular indices and the nature of the price data (Levell, 2012; International Labour Organization/International Monetary Fund/Organisation for Economic Co-operation and Development/European Union/United Nations/The World Bank, 2020)

Similarly, for the higher-level aggregation of elementary indices, several formulae have been proposed. Ideally, the selection of the index should be based on the following three steps: (1) The purpose of the index, (2) Ideal price index, and (3) Estimate-formula for calculation of the ongoing CPI (Hansen, 2006). For most countries, the major purpose of the CPI is to measure inflation or the increase in the price of a representative basket of products apart from the indexation of wages and contracts. Thus, for inflation measurement, the ideal index consists of a 'fixed basket' of goods and services consumed by a typical household in a specific period, usually a year. This suggests that the 'ideal index' would be the Lowe Index, which becomes the Laspeyres type if the weight reference period and the price reference period coincide.

However, for many countries, the results of household expenditure surveys are often obtained after a lag of one year or more, for which the base year prices are collected (price reference period). This also raises the issue of whether or not to price update the expenditure weights which depends on the response of consumers on relative price changes or the price elasticities It should be noted that in general, the fixed basket type CPI overestimates the inflation compared to the COLI as the latter allows for the substitution of products due to price changes (Hansen, 2006).

There are several sources of bias, which might creep in due to methodological issues pertaining to fixed-base indices (White, 1999; Diewert W. E., 1998). First, the Commodity Substitution Bias can occur frequently as the consumer substitute among different goods and services due to changes in relative prices, income, preferences, etc. Second, Outlet or Establishment Substitution can arise as consumers shift to new outlets which offer cheaper prices or the sampled outlets for price collection close. Third, the Introduction of New Goods shift the consumption patterns of households which can alter the expenditure shares or weights in the base year. Fourth, Elementary Index Bias can happen which can be defined as the consistent departure of the index from the 'true' or 'ideal' measure as a 'pure price index' (Australian Bureau of Statistics, 2022; Gabor & Vermeulen, 2014). Fifth, changes in qualities of items causes the Quality Adjustment Bias as the index should only measure pure price changes keeping quality constant. For example, this type of bias occurs in fast changing consumer electronic goods such as TVs or mobile phones.

Thus, there is a need to take appropriate steps to reduce these biases through various measures such as : updating the basket and weights regularly, maintaining the list of outlets/establishment and items, incorporating the new items in the basket in a timely manner, using the appropriate method to adjust for quality change (International Labour Organization/International Monetary Fund/Organisation for Economic Co-operation and Development/European Union/United Nations/The World Bank, 2020).

The emergence of digital and sharing economy has provided opportunities and also added fresh challenges in the collection of prices and computation of the CPI. The digitalisation of the economy has introduced fast paced changes in the emergence of varieties of new goods and services including digital goods and services, and altering the frequent change in consumption pattern. Concurrently, new and alternative data are more readily available, facilitating and reducing the cost involved in price collection. Increasing use of e-commerce in the wake of the COVID-pandemic and private provision of services due to sharing economy (e.g., ride sharing company like Uber and short-term tourist rental such as Airbnb) has necessitated the use of alternative data sources such as web-scraped data, scanner data/barcodes, APIs-data scraped from databases although the latter also has also its own legal and other challenges.

The rapid disappearance and emergence of consumer items implies that the prices can be temporarily or permanently missing, creating a gap in sampled items which induce a potential bias, necessitating adjustments to be made to compute the CPI. Prices may be temporarily or permanently unavailable as they are collected based on samples and of certain brands or outlets, due to supply disruptions and seasonality. The CPI manual provides several recommendations to address the issue of missing prices such as different imputation methods for missing prices and seasonal items. In case of permanently missing items, replacement can be made with items with the same characteristics. However, if the replacement item differs in quality from the missing item, quality adjustment should be made. Several methods of quality adjustment have been prescribed by the CPI manual

including the implicit methods (e.g., overall mean/targeted mean/class mean imputation, comparable replacement, overlap of both items, etc.) and explicit methods (e.g., hedonic approach, differences in production/option cost, expert judgement, etc.). The Carry Forward method, which involves carrying forward the price into the subsequent period, is not recommended as it induces unrealistic stability in the index, particularly for high-inflation countries.

One of the critical issues impinging on the monetary policy implementation is the coverage and representativeness of price data. Coverage can be defined in terms of geographical representation such a national, regional, urban/rural or some selected areas or according to different population groups based on income or jobs such as agriculture workers, industrial workers, low/middle/high-income households, etc. In most countries, the headline inflation figure is taken as a major target of monetary policy. However, the price variation across different geographical regions and income groups/jobs can provide important insights into the differential impacts of monetary policy. Thus, issues related to sample design and selection on price collection are of paramount importance to achieve the major objectives of CPI computation.

5. Stylised Facts

The eight economies chosen for the present study have diverse economic characteristics. In terms of GDP per capita, Nepal is ranked as the least developed country with a per capita GDP at 2015 constant dollars of around 1083 US Dollars, whereas South Korea ranks the highest with around 33720 constant USD, followed by Brunei Darussalam with around 29000 USD. The inflation records from 2000 to 2022 have been mixed with low to moderate inflation. The average inflation of Brunei Darussalam was less than 1%, around 2.1% in Malaysia and 2.5% in South Korea during the period. In contrast, the average inflation for Sri Lanka was more than 9.5% and about 8.8% in Mongolia, while the rest of the economies had moderate inflation of less than 8.0% (Table 1). Compared to East Asia and the Pacific, low- and middle-income, OECD members, and the World averages, inflation has been higher for the economies other than Brunei Darussalam, Korea, and Malaysia.

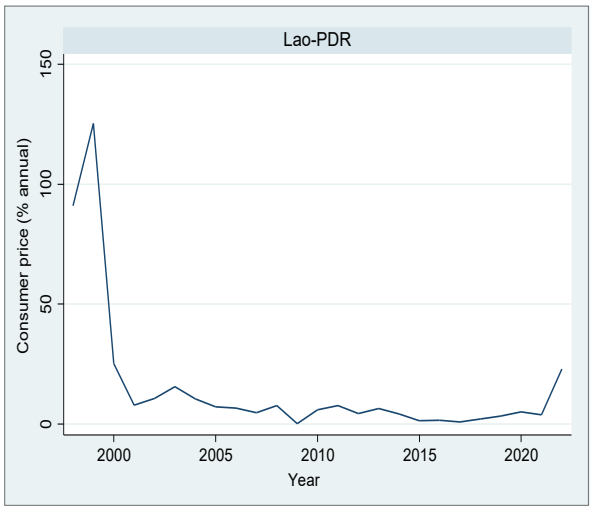
Table 1: **Macroeconomic Indicators of the Selected Countries**

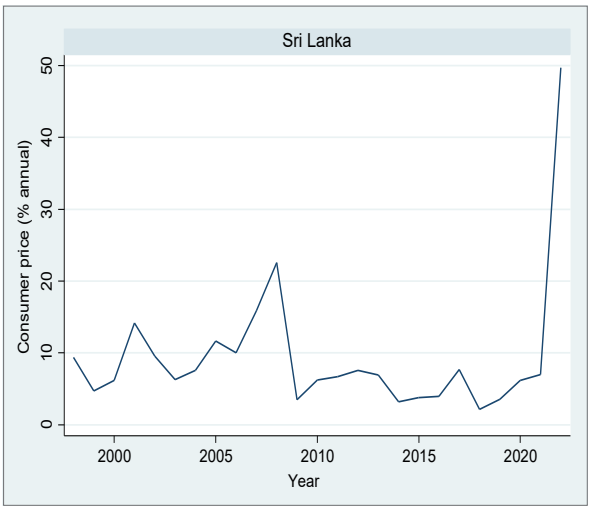
Country	Inflation (2000-2022)	Maximum Inflation (Year)	Real GDP growth (2000-2022)	Interest spread (2000-2022)	GDP per capita in USD (2022)
Brunei Darussalam	0.57	3.68 (2022)	0.74	4.96	28954
India	6.16	11.99 (2010)	6.07	NA	2090
Korea, Rep.	2.46	5.09 (2022)	3.86	1.65	33719
Lao PDR	7.17	25.08 (2000)	6.41	21.76	2599
Malaysia	2.08	3.61 (2006)	4.69	2.47	11399
Mongolia	8.78	15.15 (2022)	6.11	10.91	4250
Nepal	6.35	11.09 (2009)	4.30	NA	1083
Sri Lanka	9.65	49.72 (2022)	4.11	3.90	3988
East Asia & Pacific	2.89	8.34 (2008)	4.83	4.91	12099
Low & middle income	4.86	10.45 (2008)	5.36	6.93	5265
Least developed countries	5.72	9.46 (2022)	4.63	8.72	1075
OECD members	2.34	8.24 (2022)	1.86	NA	39002
World	3.56	7.97 (2022)	2.95	6.03	11319

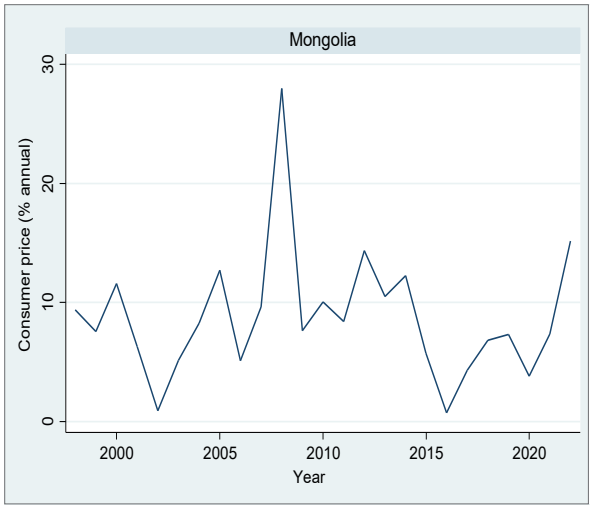
Source: World Development Indicators, 2024. Inflation is the annual average CPI inflation for the period 2000-2022. Real GDP growth is the average annual growth for the period 2000-2022. Interest spread refers to lending rate minus deposit rate (average of 2000-2022), GDP per capita in USD refers to the GDP per capita in 2015 constant USD for 2022. NA means not available. Least developed countries refer to the UN classification.

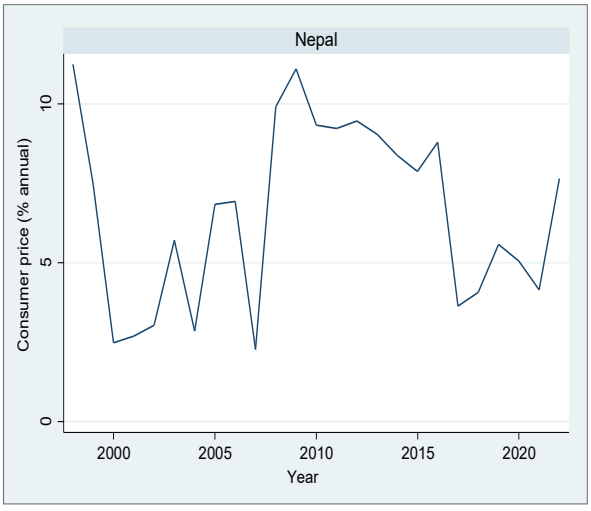
These countries also depict significant variation in inflation, with countries with higher inflation showing greater variability. Lao PDR, for example, had inflation of around 25% in 2000 and around 22% in 2022, Mongolia's inflation was around 28% in 2008, while Sri Lanka's inflation was around 50% in 2022 due to the economic crisis (Chart 2).

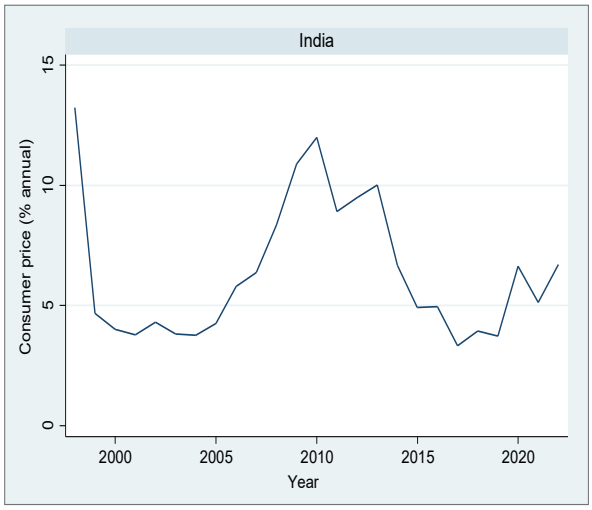
Chart 2: Inflation Rates in the Selected SEACEN Member Economies

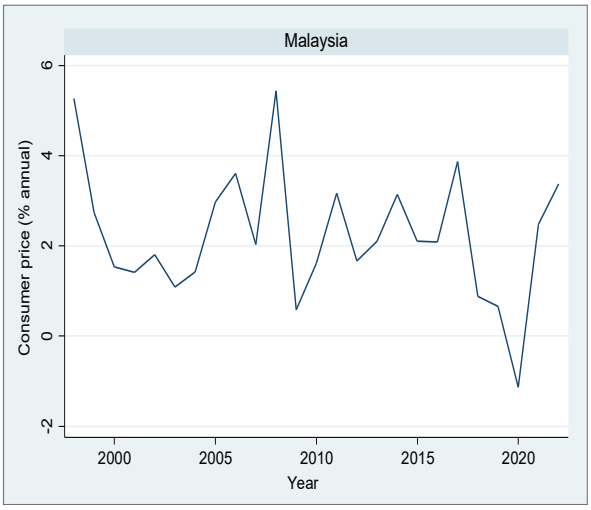


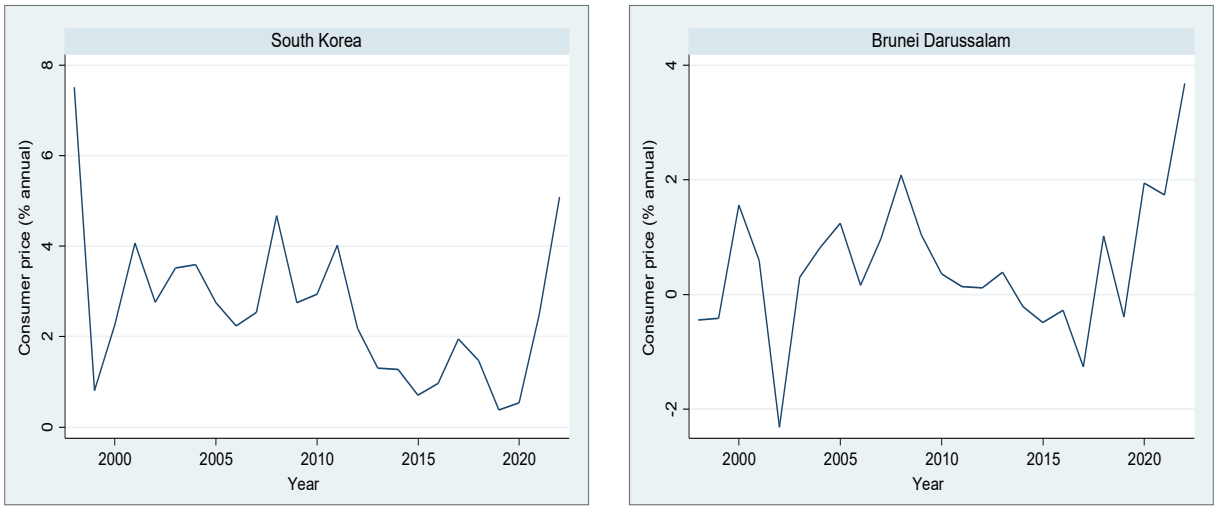












Source: World Development Indicators (2024).

The currency board arrangement with Singapore has contributed to historically low and stable inflation in Brunei Darussalam. This unique system ensures that the Brunei Dollar is pegged to the Singapore dollar on a one-to-one ratio with full currency convertibility without any cost (Brunei Darussalam Central Bank, 2023). However, a combination of demand and supply-side factors has contributed to an uptick in inflation in the aftermath of COVID-19 (IMF, 2023). Malaysia and Korea have also maintained low inflation partly due to their commitment to price stability. However, these countries maintain extensive price control mechanisms, which might have put the prices artificially at low levels, as reflected in the CPI inflation (World Bank Group, 2023). India has been able to bring down the inflation rate, especially after the adoption of the flexible inflation-targeting regime. For Nepal, relatively moderate inflation is the result of an exchange rate peg with Indian rupees helping to anchor inflation expectations.

Inflation in Mongolia has been relatively high and volatile owing to large swings in food prices mainly due to weather related shocks (Barnett, Bersch, & Ojima, 2012; The World Bank, 2023). Similarly, inflation has been moderately high in Sri Lanka, especially after the adoption of open economic policies in 1977 (Kalatunge, 2017; Colombage, 2005). For Lao-PDR, inflation has remained moderately low and stable for the last two decades. However, inflation has remained high in recent years due to the sharp depreciation of Lao Kip, resulting from the high external debt service burden and import prices (The World Bank, 2023).

Table 2: Monetary Policy Framework and Exchange Rate Regime

Country	ER regime	Monetary policy framework	Remarks
Brunei Darussalam	Currency board	ER anchor (other)	Currency board arrangement with Singapore Dollar
India	Floating	Inflation targeting framework	India has adopted flexible inflation targeting (FIT) framework since 2016-17 with a target of 4% within the tolerance band of +/-2%.
Nepal	Conventional peg	ER anchor (Other)	Exchange rate peg with Indian Rupees
Mongolia	Stabilized arrangement	Other (transition towards IT)	
Sri Lanka	Crawl-like arrangement	Inflation targeting framework	The country maintains a de facto exchange rate anchor to the US dollar. The authorities reported that their monetary policy framework is referred to as "flexible inflation-targeting."
Malaysia	Floating	Other	Includes countries that have no explicitly stated nominal anchor, but rather monitor various indicators in conducting monetary policy.
Lao PDR	Crawl-like arrangement	Other	The country maintains a de facto exchange rate anchor to the US dollar.
South Korea	Floating	Inflation targeting framework	

Sources: Annual Report on Exchange Rate and Exchange Restrictions 2022 and Author's compilation.

The compilation and dissemination of CPI are mostly entrusted to the Central Statistical Agency and Labour Ministry. However, Nepal is unique as the central bank itself compiles and disseminates the inflation data. Very few central banks compile CPI as this can create a potential conflict of interest as the central bank's major role is to contain inflation. However, this practice can have a few benefits, including a detailed understanding of the compilation methodology of CPI and the potential biases in estimation, periodic rebasing of CPI, and availability of timely and disaggregated data, thus facilitating monetary policy formulation. Moreover, relying fully on statistical agencies for CPI compilation can create potential problems without a formal mechanism or memorandum of understanding between these agencies for information and data sharing.

The basket and weights are usually derived from the nationally representative household budgets or expenditure surveys. In Nepal, for the recent rebasing, the Nepal Living Standard Survey Fourth round, conducted by the National Statistics Office, was used to derive the basket and weights instead of conducting separate household budget surveys earlier. In some cases, surveys focusing on specific geographic locations are also conducted to compile particular indices (For example, the Colombo Consumer Price Index in Sri Lanka). It is usually recommended to conduct these surveys every 5 years to reflect the rapid changes in consumption patterns of households and the emergence and disappearance of items in the market. However, these surveys are often complex and resource-intensive in terms of time and resources. As a result, there is a wide divergence among countries regarding the periodicity of such surveys.

The weightage of food items generally varies according to the level of development. As postulated by Engel's law, the proportion of expenditure on food declines as the income of households increases. For Brunei Darussalam and South Korea, which are classified as High-Income countries by the World Bank, the weight of food items is less than 20%. It exceeds more than 40% for the rest of the countries except for Mongolia. However, the share of food items has continuously declined, and the share of non-food and services has increased in each country as income level rises.

Table 3: CPI Compilation Practices

Major components	Brunei Darussalam	Nepal	India	Laos	Malaysia	Mongolia	South Korea	Sri Lanka
CPI compiling Agency	Department of Economic Planning and Statistics (under the Ministry of Economy & Finance)	Nepal Rastra Bank (Central Bank of Nepal)	Ministry of Statistics and Programme Implementation (MOPSI) and Ministry of Labour and Employment	Lao Statistics Bureau (LSB):	Department of Statistics Malaysia	National Statistics Office (NSO)	Statistics Korea (KOSTAT)	Department of Census and Statistics (DCS)
Source of Weights	Household Expenditure Survey	Household Budget Survey	Household Consumer Expenditure Survey (HCES)	Lao Expenditure and Consumption Survey (LECS)	Household Expenditure Survey	Household Socio-economy Survey (HSES)	Household Income and Expenditure Survey (HIES)	Household Income and Expenditure Survey (HIES)
Current Base Year	2015	2022/23	2012	2015 (December 2015)	2016	2020	2020	2013
Total items in basket	1058	496	299	485	424	414	458	434
Weight of food	18.83	43.91	45.86	46.1	49.2	26.1	14	44.04
Weight of non-food	81.17	56.09	54.12	53.9	50.8	73.9	86	55.96

Sources: Country case studies and respective statistical agencies.

6. Implications for Monetary Policy

The shift in monetary policy implementation has focused on price stability in recent times. Although several central banks are entrusted with multiple objectives of supporting sustainable economic growth or employment creation; financial sector stability and external sector stability as well as price stability is often accorded the highest priority as in the case of flexible inflation targeting regimes of India and Sri Lanka.

The target or the headline inflation in most countries are the national level CPI. However, countries produce different CPI aggregates catering to specific sections of the population or for particular purposes. India is an interesting case, as the wholesale price index was used as the all India inflation indicator until the introduction of national level CPI. It also produces different CPIs for agriculture labour, rural labour and industrial labour for wage rate adjustments. Additionally, core CPI, which excludes volatile components like food and fuel, is often used as a reliable indicator of headline inflation in many countries. However, for developing countries, food and fuel occupy major weights in the CPI basket and core CPI may not represent the true CPI for the general population, thus losing the information content of the CPI. South Korea, for example, reverted to national CPI in 2007 after targeting core CPI since 2000.

Although the CPI basket contains hundreds of items, the top three or four items occupy more than 50% weightage (Table 4). Consequently, inflation is mainly driven by few major items.

Table 4: CPI Weights of Major Categories

Countries	Food and non-alcoholic beverages	Housing and utilities	Transport	Restaurants and hotels
Brunei Darussalam	18.83	11.70	19.61	10.69
India	45.86	Housing has a weight of 10.07 in CPI combined	8.59 (incl communication)	
Lao PDR	46.09	5.28	15.66	8.65
Malaysia	29.5	23.8	14.6	16.1
Nepal	43.91	20.30	5.34	8.00
Sri Lanka	26.2	31.6	12.5	5.1
South Korea	14.2	17.16	11.06	14.47

Source: Country case studies.

The dominance of food and imported items makes the implementation of monetary policy particularly challenging. The weight for food and non-alcoholic beverages is more than 45% in the CPI basket for India and Lao PDR whereas for Nepal, Malaysia and Sri Lanka, it is around 35%, 30% and 26% respectively. Prices of food items are prone to supply shocks and erratic weather patterns. Thus, food prices are usually higher compared to non-food and services and display greater volatility. It is generally argued that monetary policy is more effective if the sources of inflation are demand driven.

Inflation is driven by a narrow set of prices instead of broad common movements. It is observed that food inflation is higher than non-food and services inflation for most of the countries in the medium- to long-run. For developing countries, frequent supply shocks and erratic weather patterns adversely affect crop production. With food items dominating the CPI basket, these items often drive the overall inflation. Moreover, the inflation variation is driven by a few goods and services that dominate the CPI basket (Table 5). There is also a wide divergence in the CPI basket according to rural or urban areas and different sections of population. In general, the food weight is higher in rural areas and poorer sections of the society. For example, in Nepal, the food weight in rural area is 40.68 whereas it is 33.66 in urban areas.

Table 5: CPI of Major Groups

Countries	Base year, month-end index	Food and non-alcoholic beverages	Housing and utilities	Transport	Restaurants and hotels	Overall index
Brunei Darussalam	2015=100, July 2024	115.86	94.21	101.29	110.38	106.26
India	2012=100, December 2024	205.9	181.7	171.0 (Transport and Communication)		195.4
Lao PDR	12/2025=100, July 2024	255.65	203.63	260.73	233.16	239.75
Malaysia	2010=100, September 24	155.2	129.6	121.9	152.8	133.2
Mongolia	2022=100,	173.2		161.5 (fuel)		144.6
Nepal	2014/2015=100, July 2024	166.81	177.76	153.92	183.27	168.8
Sri Lanka	2019=100, June 2024	232.8	175.6	268.4	264.9	208.1
South Korea	2020=100, September 2024	124.72	115.36	113.90	121.02	114.65

Source: Country case studies.

In addition to the direct effects, these narrow set of items also affect the overall inflation through the second-round effects on prices of other goods and services through increased cost and inflation expectations. The empirical study on India shows that the non-core inflation does affect inflation expectations, albeit smaller in magnitude compared to core inflation. The effects are more confined to the services sector and hence the set of prices driving the headline inflation and those affected by monetary policy do not necessarily coincide (Claudio, Piti, Dora, & Zakrajšek, 2021). Thus, the instruments of monetary policy which are catered to affect the aggregate demand are blunt tools due to their influence on narrow set of prices.

The findings of the country case studies emphasise the merits of analysing inflation at a more disaggregated level rather than focusing on headline or core inflation only. Moreover, the measurement of inflation is a complex task, and the computation of the index depends on underlying theoretical and practical data collection issues. This points to the importance of flexibility in the pursuit of inflation targets instead of just relying on a single number. The failure to recognise the limits of monetary policy on steering the overall inflation has also sparked debate on overly active response by the central banks, potentially exacerbating inflationary pressures. This study contributes towards a more nuanced view on the role of monetary policy and highlights its unintended consequences, with a view towards their possible mitigation (Rajan, 2023).

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CHAPTER 2

INFLATION MEASUREMENT AND ITS IMPLICATION FOR MONETARY POLICY: CASE FOR BRUNEI DARUSSALAM

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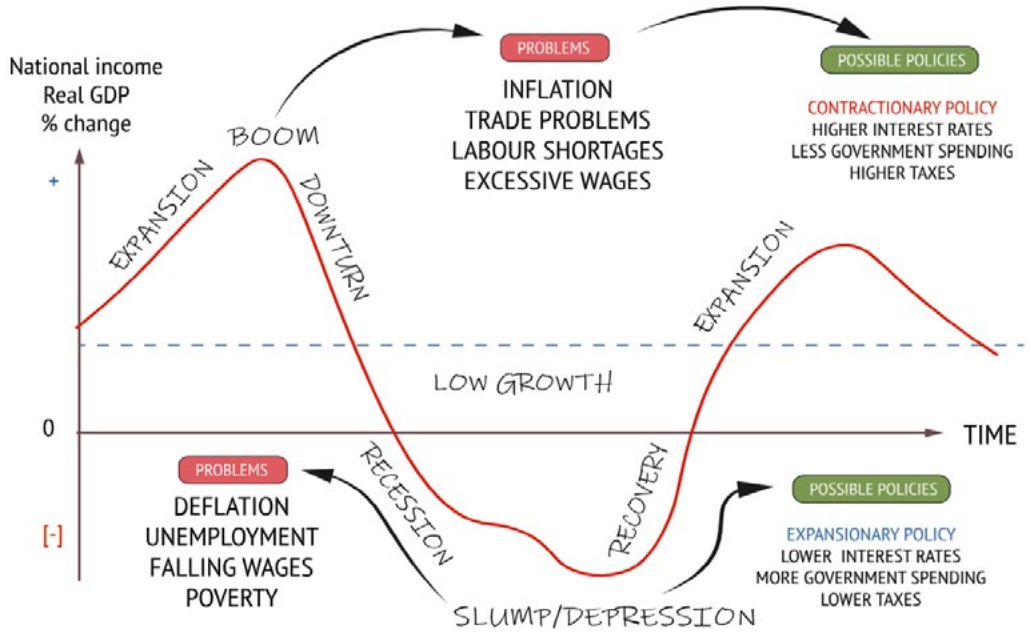
1. Introduction

Consumer Price Index (CPI) inflation is designed to measure the average price changes of a fixed basket of goods and services that are typically purchased by households over a period of time.

From a macroeconomic perspective, the inflation rate serves as an important economic indicator, which is monitored, along with other indicators such as economic growth and unemployment. Inflation, in particular, is used as an indicator for the cost of living and consumers' purchasing power over time. Persistently high inflation can lead to significant erosion in real income, decreases in domestic demand and slower economic growth. On the contrary, too low of an inflation rate, or deflation, can also be detrimental as consumers may delay their purchases, which results in slower business activities and lower economic growth.

Over time, an economy goes through business cycles, where the ups and downs are referred to as booms and troughs (Figure 1). The other stages shown in Figure 1 below indicate that an economy goes through periods of recovery, expansion, downturn, and recession. To maintain steady growth, and prevent the economy from going into recession or overheating, many economies have set targets that define optimal rates of economic growth, inflation and unemployment.

Figure 1: Business Cycles, Inflation and Unemployment (Varela, 2023)



This paper is divided into two parts: (i) the compilation of CPI and inflation measurement in Brunei Darussalam, and (ii) the impact of Brunei Darussalam's monetary policy on prices.

2. CPI Compilation in Brunei Darussalam

In Brunei Darussalam, the CPI data is compiled and published monthly by the Department of Economic Planning and Statistics under the Ministry of Economy and Finance (DEPS, MOFE). The CPI basket includes goods and services that are classified into 11 groups, following the United Nation's Classification of Individual Consumption According to Purpose (COICOP). The groups and weights in the current series (base year: 2015) are as follows:

Groups	Weights
Food and Non-Alcoholic Beverages	1,883
Clothing and Footwear	403
Housing, Water, Electricity, Gas and Other Fuels	1,170
Furnishings, Household Equipment and Routine Household Maintenance	702
Health	91
Transport	1,961
Communication	594
Recreation and Culture	664
Education	696
Restaurants and Hotels	1,069
Miscellaneous Goods and Services	767
Total	**10,000**

With changes to household consumption patterns over time in response to a change in goods and services available in the market as well as changes in household incomes, DEPS typically conducts rebasing exercises of the CPI every five years. This is done by utilising the Household Expenditure Survey (HES), to ensure that current household consumption patterns are reflected. Other than updating the weights within the basket of goods and services, the rebasing exercises may also update the classifications of goods and services, as well as take into account a new sample of outlets, or improved methodology.

Base Year	Period	Source of weights
July 1963	1963 – 1977	Based on consumption patterns of a small number of low-income families
1977	1978 – 1990	HES 1977 (Jan - Dec 1977)
1990	1990 – 2002	HES 1987/88 (Apr 1987 – Mar 1988)
2002	2002 – 2010	HES 1997/98 (Oct 1997 – Sep 1998)
Jan 2005	2010 – Aug 2013	HES 2005 (Jan – Dec 2005)
Jan 2010	Sep 2013 – May 2019	HES 2010/11 (Apr 2010 – Mar 2011)
Jan 2015	Jun 2019 – Present	HES 2015/16 (Apr 2015 – Mar 2016)

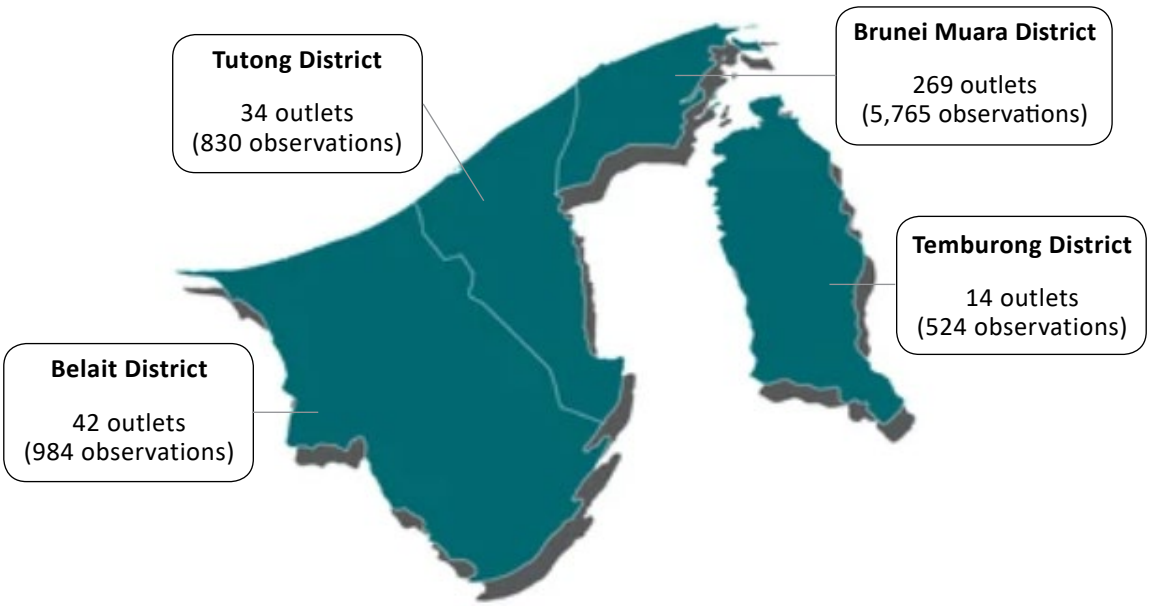
Note: HES refers to the Household Expenditure Survey. Source: Department of Economic Planning and Statistics, Ministry of Finance and Economy.

The weights for the current series are derived from the expenditure values collected in the HES 2015/2016, which reflects the average spending pattern of households in Brunei Darussalam. The weightings of the representative CPI basket of goods and services are revised once every five years[1] to reflect the latest consumption patterns and composition of goods and services consumed by residents, based on the results from the HES. Additionally, the results from the Population and Housing Census are also used to compute regional (district) weights.

Items selected for pricing collection are those with relatively high weights. Those with relatively low weights are not selected and their weights are redistributed to the selected items accordingly. On average, 8,103 price quotations of 1,058 brands/varieties are collected from 359 outlets and wet markets across the country (Figure 2). Outlets selected are based on their market share and cover a wide range of retailers and service providers commonly visited by shoppers. Information on the sales volume of the establishments are obtained from the Economic Census of Enterprises to assist in the outlet selection process.

1. Due to the COVID-19 pandemic, the Household Expenditure Survey 2020/2021 was postponed to 2023/2024, where data was collected from August 2023 – July 2024.

Figure 2: Distribution of Outlets Included in CPI Data Compilation



Prices are collected through fieldwork visits, by telephone or via websites. For missing prices, if a product is temporarily unavailable, its price change is assumed to be the same as those of other similar products. If the product is permanently unavailable, the closest substitute will be sourced to replace it. For replacement varieties, price collectors select products with significant market share and where possible, with the same quality in terms of previous product's characteristics. In these cases, price collectors consult retailers for product specifications. For new items, new products which are popular are added as and when the old ones are phased out. It is also noted that since the CPI only covers consumption expenditure incurred by resident households, non-consumption expenditures such as loan repayments, donations, purchase of houses, shares and other financial assets are excluded.

Price validation by the supervisors is carried out monthly. Interviewers are required to verify all price changes and to provide explanations for unusual movements in prices. In addition, where large variations in prices are found, further verifications are made with the respondents.

3. Administered Prices and Subsidies in Brunei Darussalam

Being a welfare state, the Brunei Darussalam government has implemented a number of initiatives to protect the well-being of the population. Among others, subsidies and price controls of certain essential items have been placed to ensure the affordability of these products. According to the Ministry of Finance and Economy, an amount of B$113.5 million of the fiscal year 2024/2025 budget was allocated for aids, grants and subsidies (The Scoop, 2024). The table below reflects the different subsidised items available in Brunei Darussalam.

Subsidised items	Maximum price
Water	B$0.11/$m^3$ for first 54.54m^3 B$0.44/$m^3$ for every subsequent m^3
Electricity	B$0.01/kWh for the first 600 kWh B$0.08/kWh for 601-2000 kWh B$0.10/kWh for 2001-4000 kWh B$0.12/kWh for every subsequent kWh
Education	Free for all citizens attending government schools for 14 years of schooling (1 year preschool, 6 years primary school, 5 years secondary school, 2 years GCE 'A' level). Brunei Government scholarships are available for citizens attending higher education institutions in Brunei Darussalam and overseas. (Borneo Bulletin Yearbook, 2003; The Borgen Project, 2017)
Healthcare	All medical services are provided free of charge to citizens and their spouses and children, except for a B$1.00 registration fee per session of doctor's consultation in government health facilities. Medicines are prescribed for free. For citizens, free overseas medical treatment is also provided for illnesses that cannot be treated in Brunei Darussalam. (Borneo Bulletin Yearbook, 2003)
Housing	Two social housing schemes with around 50% of development costs subsidised by the government; National Housing Scheme (for citizens) and Landless Indigenous Citizens Housing Scheme (for citizens from indigenous tribes). (Borneo Bulletin Yearbook, 2023) Subsidised housing rental scheme for government officers based on their salary scale and number of occupants. (Public Service Department, 2024)

In addition to subsidies, there are currently 10 categories of goods listed in the Price Control Act, Chapter 14, where prices are controlled on a long-term basis.

Price-controlled items	Maximum price	Setting Authority
Rice	Thailand fragrant rice (B$1.25/kg) Siam white rice (B$0.85/kg) Glutinous rice (B$0.76/kg)	Treasury Department, Ministry of Finance and Economy
Sugar (white, referred, granulated, cane sugar and fine grain)	B$1.25/kg	
Cooking oil	Price set depends on brand, model and import batch	Department of Economic Planning and Statistics, Ministry of Finance and Economy
Powdered infant milk		
Motor Gasoline, V-Power	B$0.81/litre	Energy Department
Motor Gasoline, RON 97	B$0.53/litre	
Motor Gasoline, RON 85	B$0.36/litre	
Diesel Fuel V-Power	B$0.79/litre	
Diesel Fuel	B$0.31/litre	
Bottled Liquefied Gas Petroleum	B$10.00/bottle (12kg) B$36.00/bottle (44kg)	
Dual purpose kerosene	B$0.20/litre	

Source: Department of Consumer Affairs (2024).

Other items, for which maximum prices have been temporarily set during peak periods, also include whole chicken, chicken eggs, cattle meat (basic meat not including meat from premium breeds and premium cuts), butter, margarine, ghee, flour as well as condensed, evaporated and cream milk. This was an initiative driven by the DEPS, MOFE as well as the Department of Agriculture and Agrifood of the Ministry of Primary Resources and Tourism (MPRT) in view of certain seasons such as Ramadhan and Syawal, where high demand is expected. This has also helped to prevent opportunistic hiking of prices of these items by retailers. The Department of Consumer Affairs (2024) also monitors and publishes prices of passenger motor vehicles, cement and selected food essentials, such as whole chicken, chicken eggs, beef, shallots, garlic, ginger and chilli on its website and the "Smart Consumer/Pengguna Bijak" app where shoppers can compare and check the latest prices of selected daily necessities as well as promotions and discounts offered by outlets.

4. Calculation and Reporting of the Final CPI Index

The methodology used to compile and calculate the monthly Consumer Price Index in Brunei Darussalam is in line with what is prescribed by the International Monetary Fund Consumer Price Index Manual 2020.

In order to compute the CPI, price observations are recorded from all four districts in Brunei Darussalam. The national average price for each item is then computed using weighted arithmetic mean prices, which are determined based on regional weights obtained from the Population and Housing Census data. The elementary index formula used is the Dutot index, defined as the ratio of unweighted arithmetic mean prices. The Dutot index can be calculated using either chained or direct methods, both yielding similar results. In the direct approach, average prices are compared to a base period. Alternatively, the DEPS employs the chained approach, progressing the index level using month-to-month changes in average prices. Elementary indices serve as the foundational blocks for CPI calculation, aggregated at progressively higher levels, such as item, sub-class, class, group, and division, using predetermined weights obtained from the HES.

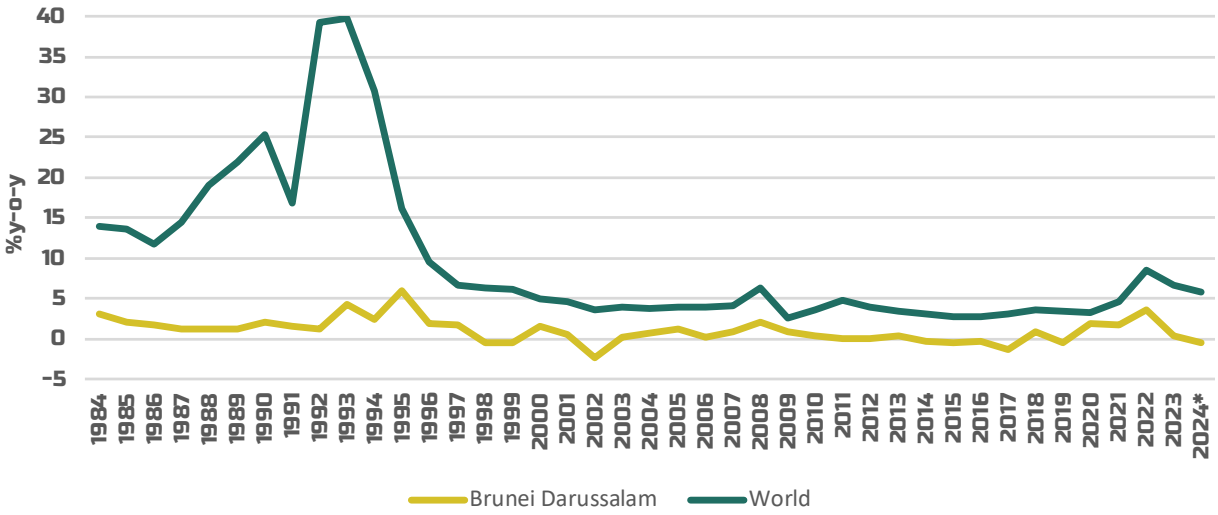
According to the Advance Release Calendar, once CPI data is compiled and verified, the monthly series is published by the DEPS with a one-month lag. The published CPI and inflation data, report and infographics are available via several avenues, including the DEPS website and their official Instagram accounts. Some publications are also shared through the MOFE website and their social media platforms.

5. Inflation in Brunei Darussalam

Compared to global inflation, prices in Brunei Darussalam have been relatively low (Figure 3). Based on available data from 1983 to 2023, annual inflation in Brunei Darussalam has averaged around 1.1%, and data from the last 20 years show that average inflation hovered around 0.7%.

Latest figures show that inflation came down significantly from 3.7% in 2022 to 0.4% in 2023, and averaging at -0.4% between January and October 2024. Being a small, open economy, which imports most of the goods and services that are consumed by households, external factors have a large influence on prices. External events, such as supply chain disruptions during the COVID-19 pandemic and an increase in certain food items such as wheat, grain and fertilisers caused by geopolitical tensions from the Russia-Ukraine conflict have had an impact on prices between 2020 and 2022.

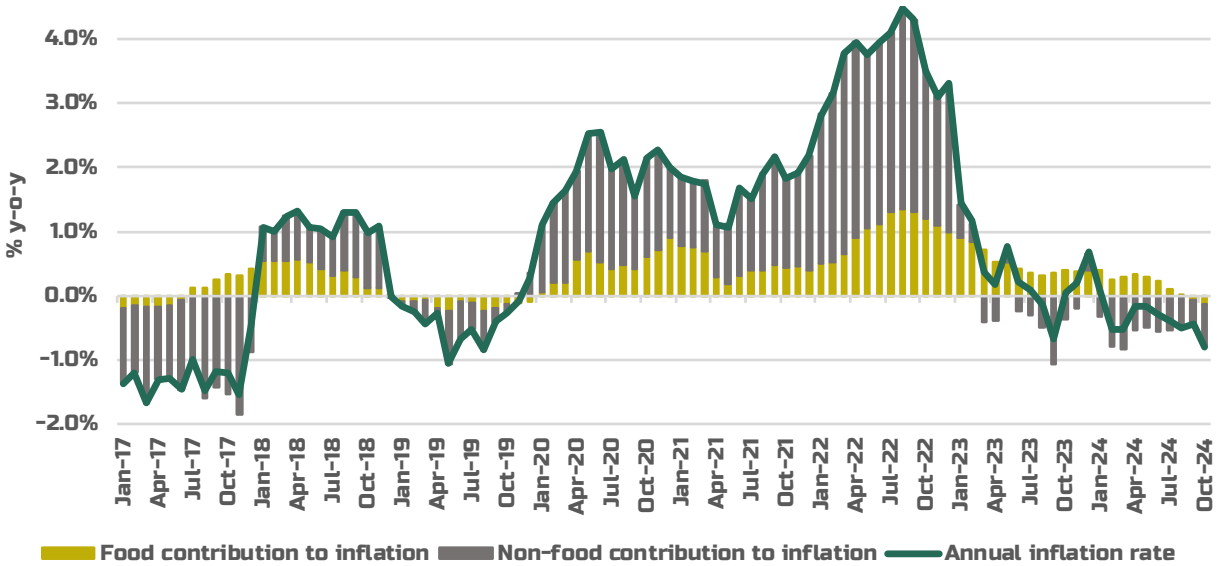
Figure 3: Comparison of Global and Brunei Darussalam Inflation



Note: For 2024, data for Brunei Darussalam reflects data from January to October 2024 and data for World reflects IMF forecasts.

The inflation in 2023, albeit easing, was mainly driven by higher prices of food items such as rice and cereals; mineral water, soft drinks, fruit[2] and vegetable juices; and meat. The tightening financial conditions and recovery in global supply chains may have contributed to easing global inflation, and the monetary policy arrangements in Brunei Darussalam have resulted in domestic inflation remaining within manageable levels.

Figure 4: Food and Non-food Contribution to Brunei Darussalam Inflation



2. An excise tax of B$4.00 (US$2.98) per deciliter on beverages with low sugar content was put in place in May 2023. Previously, only drinks with high sugar content faced excise taxes. According to DEPS, the impact of this tax on prices was recorded in July 2023.

6. Impact of Monetary Policy on Relative Prices

Central banks or monetary authorities use monetary policy to manage economic fluctuations and achieve price stability, indicating that inflation is low and stable. In times when the level of economic activity is low, an expansionary monetary policy may be adopted to stimulate the economy, where central banks may lower interest rates, reduce reserve requirements or buy government securities in order to boost money supply in the economy. This then, in turn, provides a boost in spending and investment, leading to economic growth and an increase in prices. Central banks that adopt an exchange-rate based regime may intervene in the market to depreciate their currency to boost exports. Similarly, if the economy is at risk of overheating, policymakers may adopt a more restrictive stance to cool down the economy. This may involve increasing interest rates, raising reserve requirements and selling off government securities. This can cause money supply to shrink, which limits household and business activities in the economy, which subsequently leads to lower prices.

For many central banks, an inflation target is set, which is deemed 'optimal' for long-term economic growth. In the U.S, U.K, and Euro Area, this target is set at 2%. Unlike many central banks around the world, Brunei Darussalam is not an inflation-targeting country. Nonetheless, Kok (2015) suggests that the Brunei Government has created an "implicit inflation target" of 0.0% +/- 1.0% through its implementation of subsidies and administered price controls on certain goods and services. Through these mechanisms, the level and volatility of inflation are much lower compared to that of a private market.

The Brunei Darussalam Central Bank's (BDCB) objective of maintaining price stability is achieved by means of its two-pronged monetary policy as follows:

(i) a Currency Board Arrangement (CBA), which is underpinned by

(ii) the Currency Interchangeability Agreement (CIA) with Singapore, where banks and monetary authorities in both countries are obliged to accept and exchange each other's currencies at par and without charge, into their own currency. The Brunei dollar is also accepted as customary tender in Singapore and vice versa for the Singapore dollar in Brunei Darussalam.

With these arrangements in place, the Brunei dollar is pegged to the Singapore dollar at par and essentially imports the monetary policy of Singapore. The Monetary Authority of Singapore (MAS), on the other hand, adopts a managed float exchange rate regime, where the Singapore Dollar Nominal Effective Exchange Rate (S$NEER) has historically been maintained at an appreciating trend. Considering that most of the goods in the CPI basket are imported, a stronger currency helps to dampen the effect of imported inflation. This, along with subsidies and price controls set by the Government of Brunei Darussalam on selected goods, has contributed to the overall low and stable inflation in the country.

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CHAPTER 3

INFLATION MEASUREMENT AND ITS IMPLICATION FOR MONETARY POLICY IN INDIA

By
Soumasree Tewari *and* **Rishabh Kumar**[1]

1. Introduction

India is now the fastest growing large economy in the world and a main driver of global growth. According to the IMF (WEO, April 2024), India's growth is projected to remain strong in 2024 and 2025 driven by robust domestic demand and demographic dividend. Notwithstanding sizeable headwinds from the unprecedented pandemic followed by overlapping shocks from geo-political conflicts and climate changes, India has shown remarkable resilience and faster rebound of growth. Inflation is also easing, although unevenly amidst high volatility in food prices. In 2023-24, headline inflation moderated to 5.4% from 6.7% in 2022-23 reflecting calibrated fiscal and monetary policy mix to improve domestic supplies and keep inflation expectations anchored. Inflation dynamics in India has been driven both by global and domestic factors. With food as the dominant component in the consumption basket, supply shocks and weather disturbances remain a major driver of headline inflation. Moreover, as a net importer of crude oil and some food products like edible oil, movement in global commodity prices also impact the inflation trend.

In order to monitor the cost of living of the targeted sections of the population, multiple measures of inflation have evolved over decades, catering to specific classes including the wholesale price index (WPI) and retail price indices for households, agricultural labourers (CPI-AL), rural labourers (CPI-RL) and industrial workers (CPI-IW). The latest measure of the general level of prices in this series is a combined consumer price index for the household (CPI-C), which was made available from 2011, and has been used as the target rate under the flexible inflation targeting (FIT) regime. The current base year of 2011-12 considers 299 categories/items covering both rural and urban sectors.

India's adoption of the FIT regime with a target of 4% (+/- 2% tolerance range) in 2016-17 has been a significant milestone explicitly recognising the Central Bank's core mandate of price stability. The FIT regime has strengthened monetary policy credibility and aided in the anchoring of inflation expectations.

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In this set up, this paper elaborates on the inflation measurement in India and their dominant drivers. As India has adopted the FIT regime, this paper also analyses the effectiveness of FIT in imparting stability to the headline inflation and the sectoral convergence when the CPI basket is dominated by food which is subject to frequent supply shocks contributing greater volatility to the headline inflation. While supply management measures by the Government are crucial in containing the impact of supply shocks on food prices, effectiveness of monetary policy plays a critical role in anchoring inflation expectations and is essential for inflation stabilisation. Section 2 discusses inflation measurements in India, section 3 presents some stylised facts on inflation dynamics and drivers, section 4 analyses the challenges and effectiveness of monetary policy in the FIT regime, and finally section 5 concludes.

2. Inflation Measurement in India

2.1 India's Inflation Measures and Distribution

In order to comprehend the multifaceted nature of inflation and their impact on the cost of living of different sections of the economy, various measures of inflation are used in India (Annex 1). Changes in the prices of goods at the wholesale/producer level are gauged by the Wholesale Price Index (WPI) whereas changes in prices of goods and services at the retail level are measured by the Consumer Price Index (CPI). The WPI provides insights into input cost pressures faced by businesses, while the CPI reflects the impact of prices on household budgets. Apart from these primary indices, two additional metrics of inflation, *viz.* the Gross Domestic Product (GDP) deflator and the Private Final Consumption Expenditure (PFCE) deflator which measure inflation at a broader level or specifically in household consumption expenditure, provide a complementary perspective to the CPI.

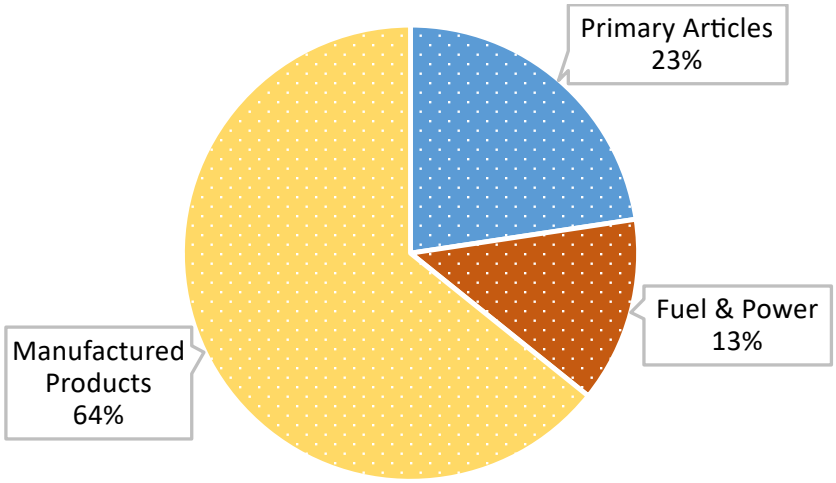
First published in 1942, the WPI tracks wholesale/producer prices, focusing on the change in wholesale prices of commodities traded across the country (Annex 2). It serves as a key indicator of industrial production costs. Traditionally, the WPI was the primary indicator used for monetary policy making due to its availability at higher frequency, and its focus on the national level average production costs in the absence of an all-India consumer price index. However, WPI's lack of direct link to household experiences and exclusion of the services sector limits its effectiveness in assessing inflation impact on broader economic well-being. With the current base year as 2011-12, it comprises 697 commodities and broadly categorised into three main groups. The weightage assigned to each commodity are based on their wholesale transaction in the economy **(Chart 1)**. Commodities with a higher value of output or those significantly impacting production costs receive a higher weightage.

1. Primary Articles (22.62% weightage): This group encompasses essential agricultural and mining products like food grains, oilseeds and cotton, minerals and crude petroleum and natural gas.

2. Fuel and Power (13.15% weightage): This group includes fuels like petroleum products, electricity and coal, playing a critical role in transportation, power generation, and industrial processes.

3. Manufactured Products (64.23% weightage): This group covers a wide range of finished goods like textiles, chemicals, machinery, and electronic items. Variations in their prices reflect changes in production costs, demand patterns, and global commodity prices.

Chart 1: Comparative Weights of WPI (Base: 2011-12)



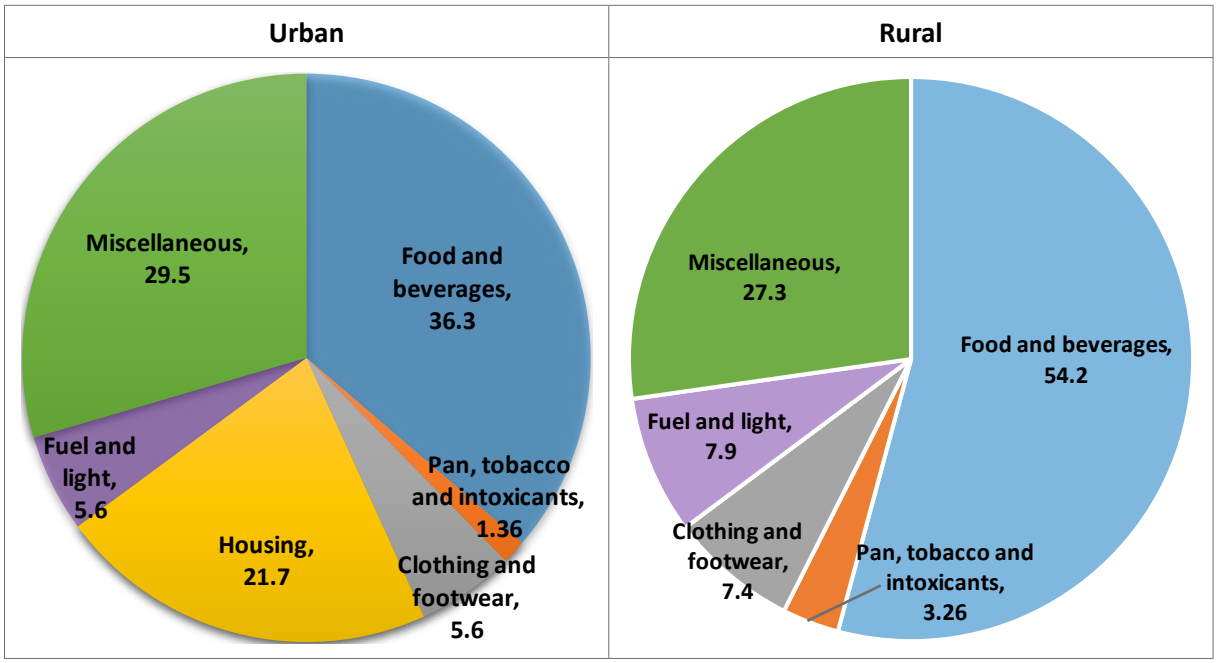
Source: Office of Economic Adviser, Ministry of Commerce.

The Consumer Price Index (CPI), measures retail prices of a basket of goods and services used by households across different population segments. It is crucial for understanding the inflation faced by households, impacting purchasing power, wage negotiations, and overall economic welfare. Two different Government agencies, *viz.,* the Ministry of Statistics and Programme Implementation (MOSPI) and the Ministry of Labour and Employment, publish various measures of CPI. Each index has its own set of weights and the base period used. There are also methodological differences between indices, such as the way in which prices are collected (White, 2014).

The CPI-combined (CPI-C) has two distinct variants - urban CPI and rural CPI - each with a basket of goods and services reflecting the spending patterns of their respective populations. Unlike the pre-existing variants representing certain sections of the economy, this index, released since 2011, has the advantage of being used as one composite CPI to represent all the sectors and sections of the economy. The weights assigned to urban and rural CPI are based on more representative household consumption expenditure data (Chart 2).

Chart 2: Components of CPI-C (Base 2012)

Percent



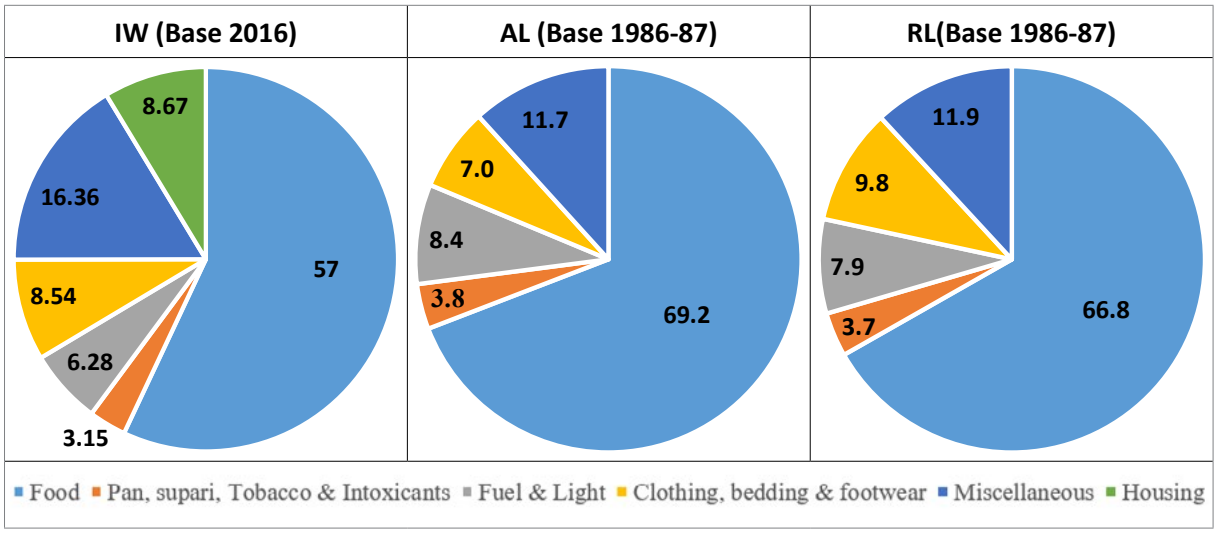
Source: MoSPI.

Apart from this, the Labour Bureau, Ministry of Labour and Employment releases CPI for Rural Labour (RL) and Agricultural Labour (AL). CPI-IW measures inflation faced by industrial workers in factories, mines, plantations, railways, public motor transport undertakings, electricity generation and distribution establishments and ports and docks. It is compiled based on retail prices collected from 317 markets spread over 88 industrial centres. The items are grouped into six main categories with their respective weightage reflecting typical spending patterns (Chart 3). Understanding the weightage of these components within the CPI-IW allows policymakers to tailor economic measures and adjustments like Dearness Allowance (DA) to better address the specific inflationary pressures faced by industrial workers. Further, the CPI-IW series has a base year of 2016 and geographical coverage across all the states.

On the other hand, the CPI-RL and CPI-AL pertain to rural and agricultural labour households, respectively. Sample household under RL is defined as one whose income during the last 365 days was from wages paid for manual labour in agriculture and non-agriculture occupations. A household is classified under AL if primary income comes specifically from wage-paid manual labour in agricultural activities. These indices are compiled based on data from 600 sample villages from 20 states every month.

Chart 3: Composition of Other Measures of CPI

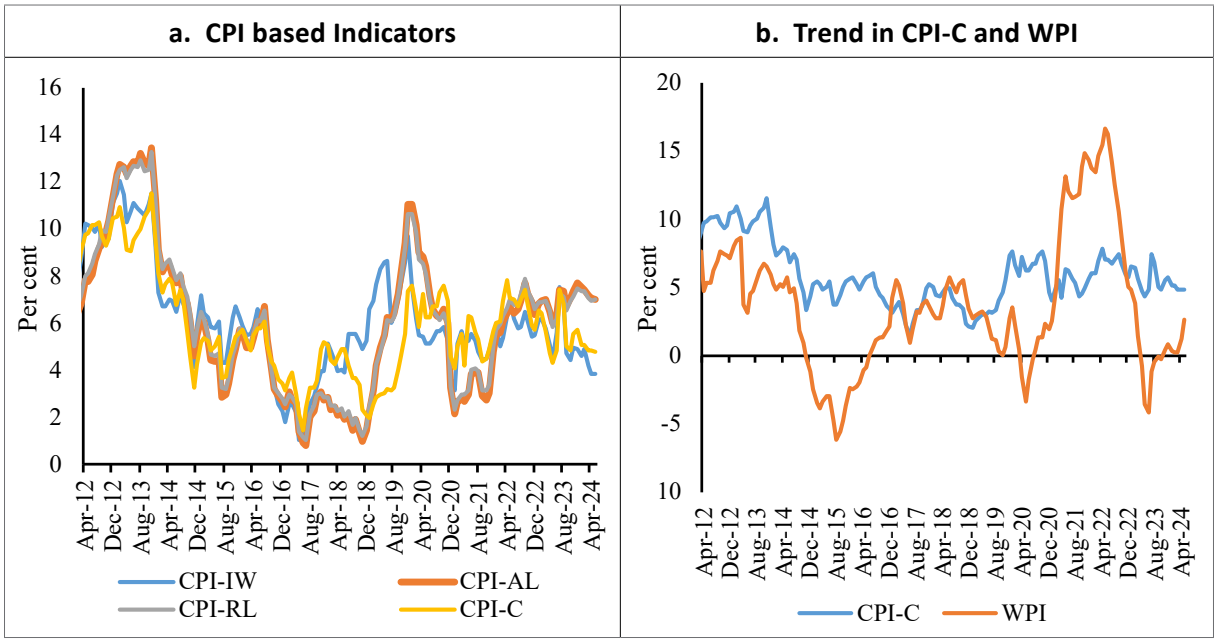
Percent



Source: Ministry of Labour and Employment.

The Wholesale Price Index (WPI) and Consumer Price Index (CPI) inflation, at times, exhibits divergent trends due to fundamental differences in their scope, composition, and weightage. While WPI measures the price changes at the wholesale level for goods traded between businesses, CPI gauges the price changes experienced by consumers for a basket of goods and services. This distinction leads to variations in their responsiveness to economic factors and their sensitivity to specific price fluctuations. One of the primary reasons for the divergence is the weightage assigned to food items in each index. CPI places a significantly higher weight on food (around 46% at a combined level) compared to WPI (around 24%). Another contributing factor is the coverage of services. WPI excludes services altogether, while CPI includes a substantial portion of services (with a weight of about 23% in the CPI basket). This difference reflects the distinct nature of the two indices. WPI is primarily concerned with the prices faced by manufacturers and producers, while CPI aims to capture the overall inflation experienced by consumers. While the CPI and WPI has exhibited co-movement over a period, the WPI series has much sharper swings as compared to the CPI with sharp spikes in oil and food prices at the wholesale level and non-inclusion of services (Chart 4). As an ideal index is expected to satisfy two major criteria of better tracking the purchasing power of the average consumer and capture movement in the general price level with international comparability (Nadhanael and Pattanaik, 2010), the CPI with the inclusion of the services sector and covering the common households, has been chosen as the primary indicator of inflation. WPI remains an important measure for monitoring manufactured products inflation and understanding cost pressures faced by industries.

Chart 4: Co-movement of Inflation Indicators



Source: Authors' calculations.

2.2 Choice of Inflation Metric for Monetary Policy

Prior to the adoption of flexible inflation targeting, inflation projections in terms of WPI alone was communicated as the various available measures of CPI (IW, AL and RL) addressed prices facing specific sections of the society. However, with the availability of a nationally representative combined CPI (CPI-C) series, the RBI has adopted headline CPI-C for providing inflation projections since October 2013. The Expert Committee to Revise and Strengthen the Monetary Policy Framework noted various advantages of using CPI-C over other inflation metrics (RBI, 2014). Firstly, the provisionally released WPI numbers were more frequently revised as compared to CPI-C. Secondly, while there are other secondary price indicators like national income price deflator, CPI is closer and more relevant to households. Finally, an appropriate inflation indicator should be forward looking, tracking inflation expectations. In this regard, the committee noted that high weight of food and fuel in the CPI basket impart the largest and most persistent impact on inflation expectations.

2.3 CPI Measurement in India

The CPI for entire urban and rural population of the country measure the inflation in the economy based on retail prices faced by households and is published by the National Statistical Office (NSO) of the Ministry of Statistics and Programme Implementation (MOSPI). The latest base is 2012=100[2] covering 299 commodities with 6 major categories; (i) food and beverages; (ii) pan, tobacco; (iii) clothing and footwear; (iv) housing; (v) fuel and light; and, (vi) miscellaneous.

2. NSO has released the Household Consumption Expenditure Survey (HCES), 2022-23. The CPI base revision is not available yet.

There are two essential constituents of the CPI namely, (i) the weighting diagram and (ii) retail prices. The weighting diagram is calculated on the basis of a periodical survey of the household consumption expenditure (to determine the consumption pattern) among the population group to which the CPI relates. The weighting diagram along with the base prices of goods and services, constitutes the basic framework on which the index series is compiled monthly. The recurring data necessary for its compilation are the retail prices (of goods and services featuring in the index basket) collected at suitable intervals. The index is compiled by using the Laspeyres' base weighted formula because of its inherent practical advantages.

The items retained for pricing are grouped into three categories, on the basis of frequency of price collection namely, weekly, monthly and six-monthly. In the weekly price schedule, items such as cereals, vegetables, oils, etc., for which the prices are sensitive and vary frequently, are retained. The prices for these items are collected on specified 'price collection day' of the week in each selected market. Prices of items like cinema tickets, furniture, utensils, household appliances, transport, etc., are collected once in a month because the prices of such items are not expected to show fluctuations over different weeks of a month. Prices of tea leaves, cigarettes, barber charges, toilet soap, clothing and footwear items are also collected once a month for the same reason. The prices for these items are collected on the first price collection day of the month in each selected market. The prices of items like school/college fees, school/college books, etc., are collected once in six months on a staggered basis. Data on house rent are collected once in six months in respect of each sampled dwelling since house rents do not fluctuate frequently. In case of perishable items, the prices are collected on a fixed price collection day and time every week/month. In this case, it is essential to maintain the time of the price collection so that prices of items of the same quality are collected each week.

Prices are collected from 1181 village markets and 1114 urban markets distributed over 310 towns of the country. The survey include: (i) items for which more than 75% of households have reported consumption; (ii) items accounting for 1% or more of total expenditure at subgroup level; and, (iii) all Public Distribution System (PDS)[3] items. The prices of items are included which have been reported from at least 25% of markets, separately for rural and urban sector and constitute more than 70% weight of the respective Sub-groups/Groups (CPI Manual, 2015).

In the case of missing prices, the current month price is imputed by multiplying the price of the same item in the previous month with average price relative of current month prices to last month's prices for the rest of markets of the same item where both current and previous month prices are available. If prices of fresh fruits and vegetables are not reported in a particular month, the weights of such items are distributed to other items of the respective Section/Sub-group.

3. The Public Distribution System (PDS) is a system of distribution of food grains at affordable prices for the economically vulnerable section of the society by the Government.

2.3.1 Housing Rent Index

Apart from food, housing constitutes an important part of the CPI basket as a major proportion of expenditure for households is generally for housing and related expenses. In India, as in the majority of countries, acquisition of a house is treated as capital expenditure. Thus, the expenditure incurred on the purchase of a house is not taken into account as consumption expenditure for purpose of the weighting diagram. However, the expenditure incurred on payment of rent including minor repairs, if incurred by the tenant, is accounted for construction of the weighting diagram. Further, data on house rent is also collected regularly for compilation of the index. Sample dwelling units for collection of houses rent data are of three types: (i) rented dwellings, (ii) dwellings supplied by employers under various labour or other acts completely free[4], and (iii) self-occupied. The dwellings which are provided by employers for which house rent allowance is not permitted in addition to license fee charged by the employer, also come under the category of rented dwellings (CPI Manual, 2015).

The change in rent and related charges which constitute a single item under housing group is captured through the Repeat House Rent Surveys (RHRS) conducted in the form of six-monthly rounds. The house rent index is compiled by the chain base method and is the weighted average of rent indices of rented, rent free and self-owned dwellings (with comparable rented dwelling), the weights being proportions of the three categories. Since self-owned without comparable rented dwellings are replaced, its share of weight is apportioned to rented dwellings.

3. Inflation Dynamics in India: Some Stylised Facts

3.1 Global vis-à-vis India's Inflation Dynamics

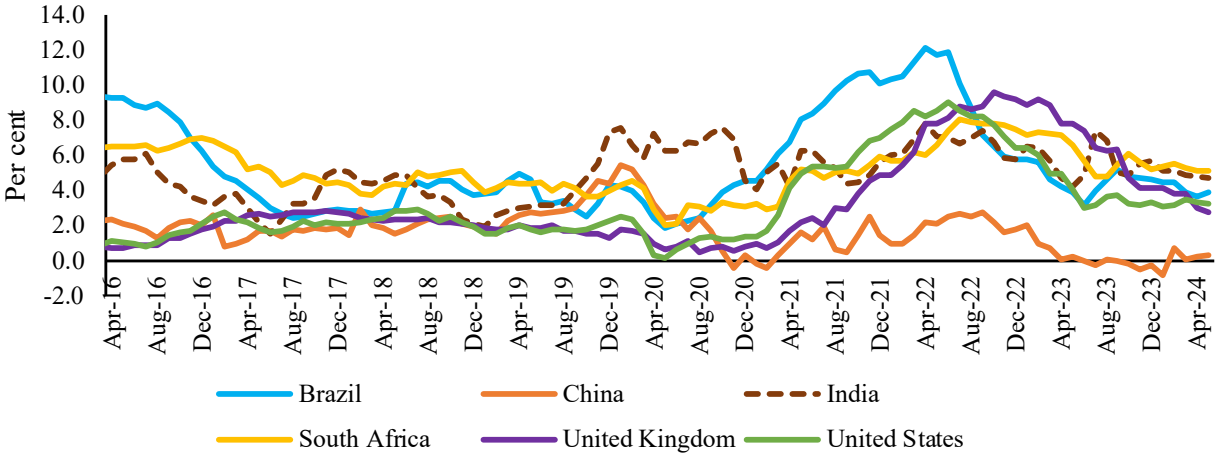
Given the large weight of food in the CPI basket, India's CPI inflation has often been driven primarily by food price shocks with global crude oil price volatility also being an important driver of domestic inflation on several occasions.

After the introduction of the inflation targeting regime in 2016-17 and prior to the onset of the pandemic, inflation remained range bound. However, the onset of the pandemic in the early 2020, altered India's inflation path as was witnessed across countries in the world following simultaneous setbacks from both demand and supply shocks during the pandemic (Chart 5). The inflationary peak in India was, however, observed much earlier before its peers in both the advanced and emerging economies, driven primarily by supply shocks amidst the pandemic. The steady and gradual reinstatement of the domestic supply chain and demand recovery with a timely and well calibrated mix of fiscal

4. The dwellings which are provided by employers for which house rent allowance is not allowed, also come under the category of rented dwellings. Earlier, the Government used to charge 10% of the basic pay as the license fee besides the house rent allowance which used to be a fixed percentage of the basic pay. Thus, the rent of such accommodation depended on the basic pay of the employee occupying the dwelling.

and monetary policy contained the surge with some sporadic spikes. Inflation persistence was much lower in India in the post-pandemic period unlike its peers and other major advanced economies (AEs). One important distinct feature of this divergence was the persistence of sticky services and core inflation which was the main driver in the major AEs while India's consumption basket was dominated by intermittent supply driven food inflation. Anti-inflationary monetary and liquidity measures played a major role in limiting the second-round effect of the inflationary surge and preventing any wage-price spiral, along with timely supply management measures.

Chart 5: Cross-country Headline Inflation

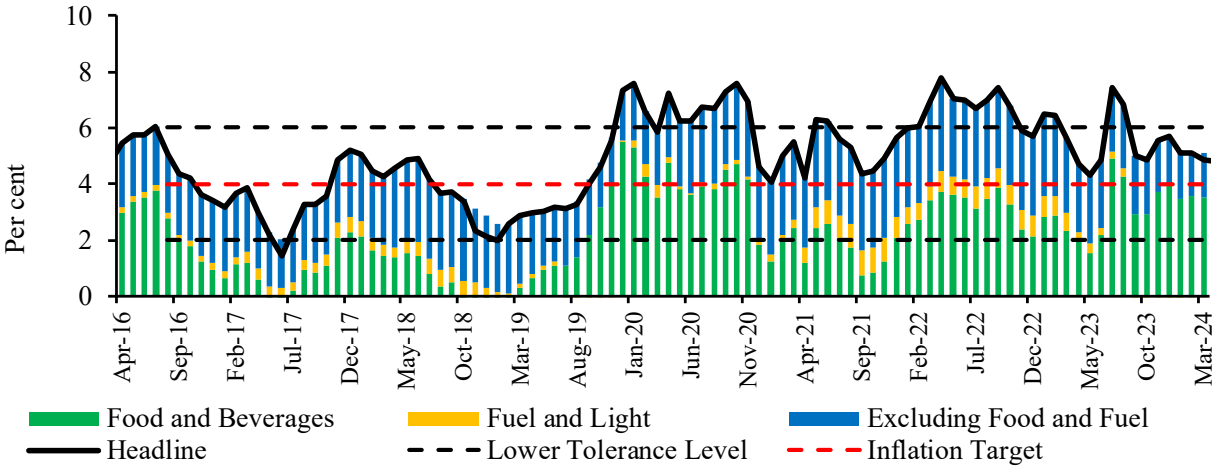


Source: IFS, IMF.

3.2 Drivers of CPI Inflation in India

Average CPI inflation fell from around 10% in 2013-14 to 5.4% in 2023-24, barring the period of overlapping shocks in the post-pandemic period (Table 1). The high inflation during 2012-13 and 2013-14 was mainly attributed to the sustained pressure on food prices from delayed and uneven monsoon seasons and pass-through from global commodity prices and exchange rate changes along with administered price revisions in fuel products (RBI, 2013). The sharp decline recorded in the inflationary trend in 2014-15, apart from the monetary policy interventions, was mainly attributed to the sharp correction in food inflation aided by a range of supply management measures and fall in international commodity prices (RBI, 2013 and 2014). With the moderation in food prices and adoption of the FIT approach from 2016-17, the overall CPI inflation undershot the target of 4% for 2017-18 and 2018-19. The inflation levels, however, increased due to supply disruptions during the nationwide lock down during COVID-19 in 2020-21 and 2021-22, followed by the Ukraine crisis since 2022-23 (Chart 6). While the standard deviation has remained range bound since 2012-13, the relatively higher values for 2014-15 and 2019-20 are attributable to the transition in the inflationary trend during these years. The skewness is negative for most of the years indicating a distribution with more months with lower-than-average inflation rates than months with higher-than-average inflation rates.

Chart 6: Composition of Headline Inflation



Source: MOSPI and Author's calculations.

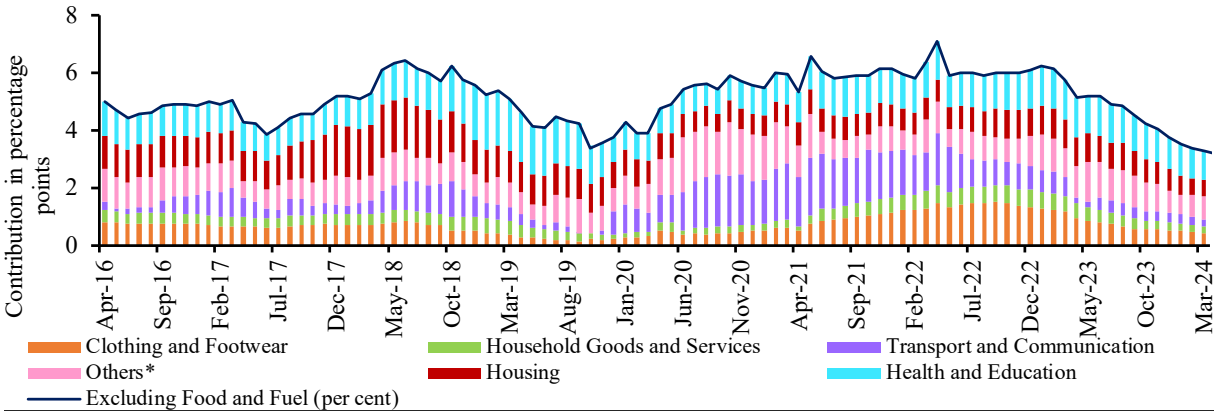
Table 1: Descriptive Statistics of Headline Inflation

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
Mean	10.0	9.4	5.9	4.9	4.5	3.6	3.4	4.8	6.2	5.5	6.7	5.4
Standard Deviation	0.5	1.3	1.5	0.7	1.0	1.2	1.1	1.8	1.1	0.9	0.7	0.9
Skewness	0.2	-0.2	-0.1	-0.9	0.2	-0.2	0.1	0.5	-0.7	-0.1	-0.1	1.5
Kurtosis	-0.2	-0.5	-1.0	-0.1	-1.6	-1.0	-1.5	-1.4	-0.7	-1.0	-0.6	1.6
Median	10.1	9.5	5.5	5.0	4.3	3.4	3.5	4.3	6.5	5.6	6.7	5.1
Maximum	10.9	11.5	7.9	5.7	6.1	5.2	4.9	7.6	7.6	7.0	7.8	7.4
Minimum	9.3	7.3	3.3	3.7	3.2	1.5	2.0	3.0	4.1	4.2	5.7	4.3

Note: Here Financial Year is April-March.
Source: RBI, Authors' calculations.

The stable core inflation (excluding food and fuel group) (weight of 47.3% in the basket), comprising mainly of housing, clothing and footwear, transport and communication and household goods and services, recorded a spike in 2022-23, owing to the post-pandemic increase in global commodity prices, particularly, food and energy, supply chain bottlenecks operating through the Ukraine war and subsequent demand recovery. Core inflation, however, witnessed sustained moderation thereafter with normalisation of supply chain, moderation in global commodity prices and lagged impact of a cumulative 250 bps policy rate hike by the Reserve Bank during May 2022 to February 2023 (Chart 7).

Chart 7: Drivers of CPI Excluding Food and Fuel Inflation



**:* Includes pan, tobacco and intoxicants, recreation and amusement and personal care and effects.
Source: RBI.

3.3 Inflation Impact and State and Sectoral Divergence

While inflation divergence persists across various Indian states with some states recording inflation above the country average, inflation dispersion across states has moderated gradually in 2023-24 from 2012-13. State level inflation converges to the national average over time, validating the choice of the national level consumer price inflation as the nominal anchor for monetary policy in India (Kundu et al. 2018). The inflation dynamics also present a nuanced picture, marked by distinct trends in rural and urban areas. While both rural and urban inflation co-move, rural inflation has generally remained higher (Chart 8). Moreover, states with above national average inflation often have a higher rural urban inflation gap suggesting the dominance of relatively higher rural inflation being one of the factors driving the state inflation divergence (Chart 9).

Chart 8: Rural and Urban Inflation

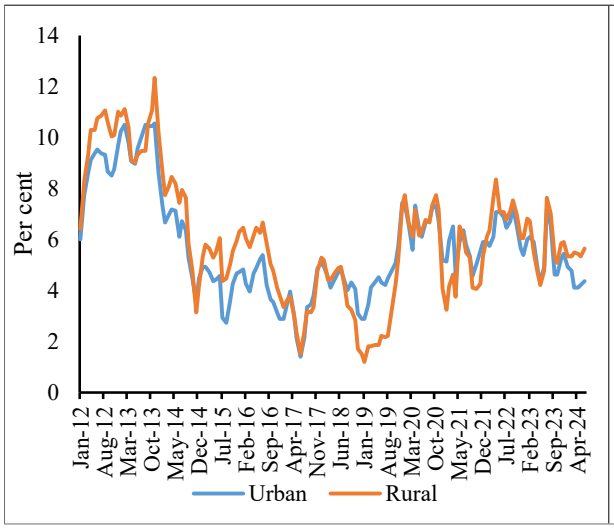
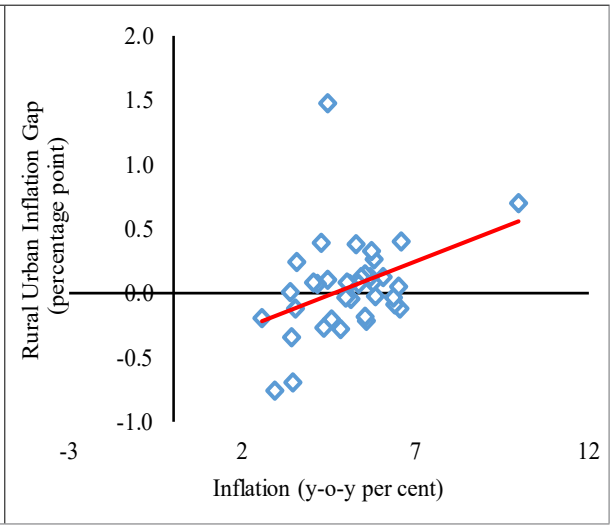


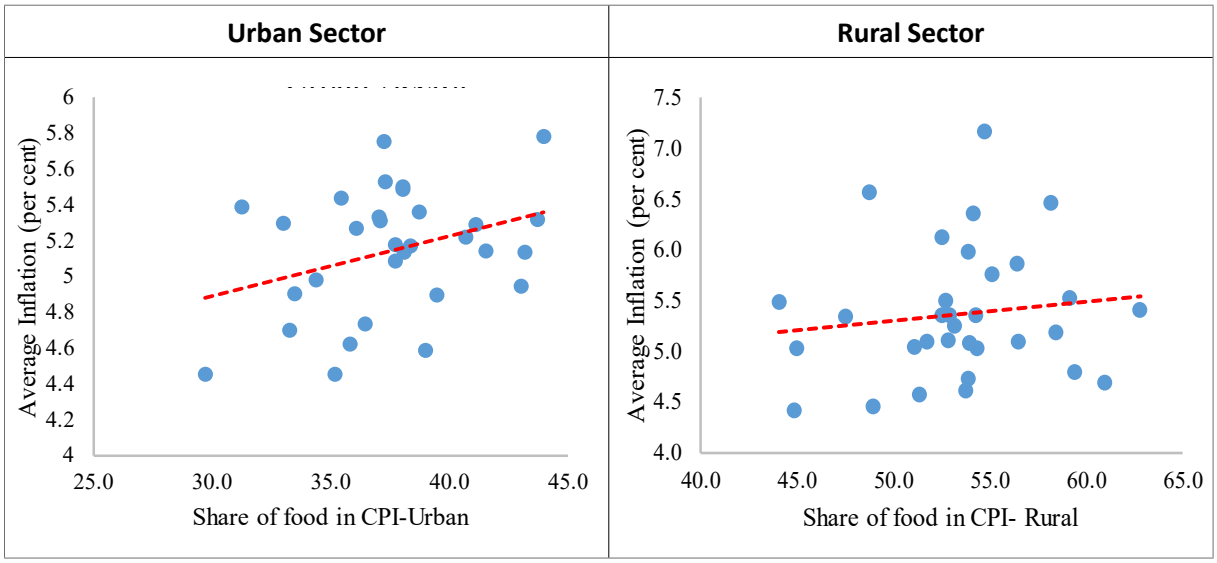
Chart 9: Statewise Inflation and Rural-Urban Gap, 2023-24



Source: MOSPI and Authors' estimates.

While the studies have shown the role of a combination of demand, supply, structural, monetary and fiscal factors in regional inflation dynamics (Jha et al. 2019), one of the primary drivers of divergence is the varying share of food in the rural and urban sector across states. The rural-urban differential is often driven by transitory factors which correct quickly, and inflation rates converge over time (Bhoi et al. 2020). Higher share of food is often positively correlated with higher average inflation in states which supports the existing literature on the temporary nature of rural urban divergence in India (Chart 10).

Chart 10: State-wise Inflation and Share of Food in the CPI Basket



Source: MOSPI and Authors' estimates.

As localised factors could influence the inflationary pressures, understanding inflation persistence at the disaggregated subnational level becomes important. State-wise inflation persistence has been tested following Roache (2014) and Gamber et al. (2016) by calculating half-lives i.e., the time taken for dissipating half of a shock to the monthly state-wise inflation for the period January 2014 to October 2023 based on first order autoregressive (AR (1)) models as below:

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \varepsilon_t$$

The advantage of the AR (1) is that the half-life is a continuous variable. However, one limitation is that by ignoring the higher order AR coefficients, there is also risk of mismeasuring the persistence. Half-life (HL) to the inflation shock is measured as:

$$HL = \frac{0.5}{1 - \beta_1}$$

The estimated half-life of inflation for all-India is 3.7 months which corroborates with literature on cross-country half-life estimates. Cross-country half-life estimates have varied from less than half of one quarter (in case of Canada and New Zealand) to over

four quarters (in case of Romania) (Roache, 2014). Barring a few states, inflation across the majority of states takes mostly less than 6 months for the shock to dissipate by 50% (Chart 11a and 11b). The relatively low inflation persistence across states also indicates the transitory nature of inflation driven by supply shocks, which normally corrects within a short period.

Chart 11a: State-wise Weightage in CPI Basket

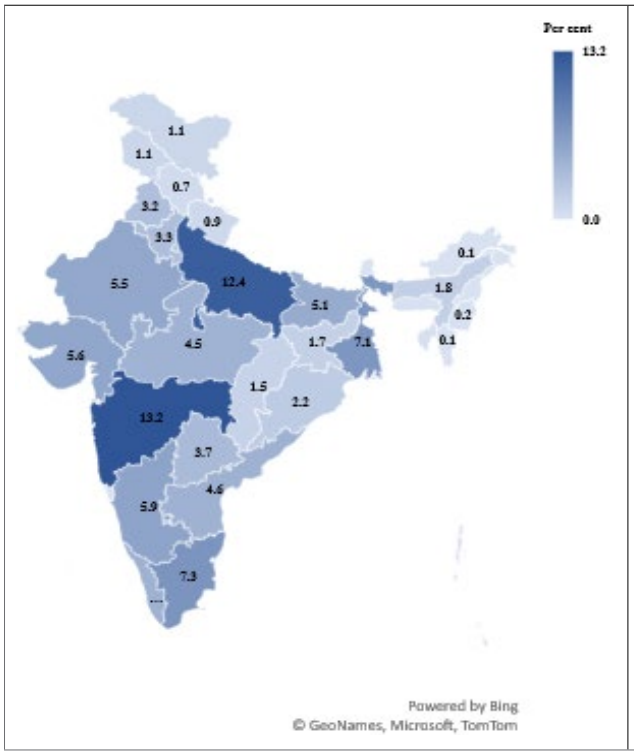
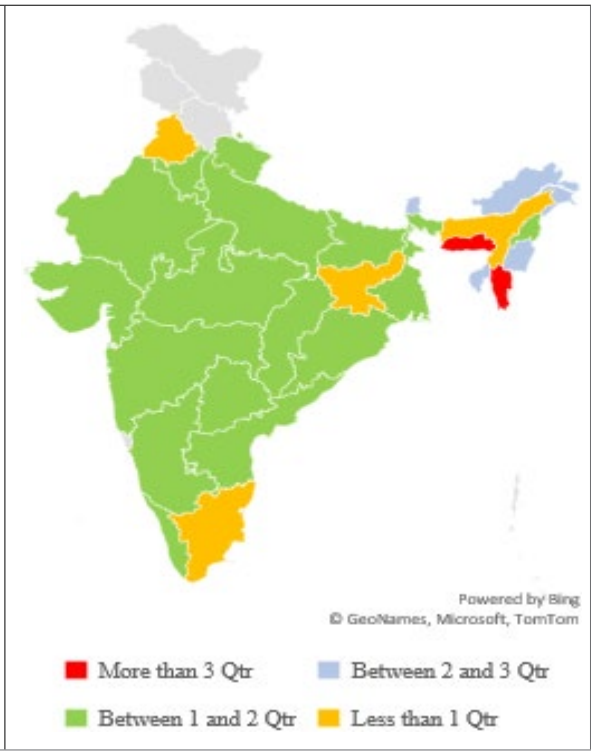


Chart 11b: State-wise Inflation Shock Half Lives



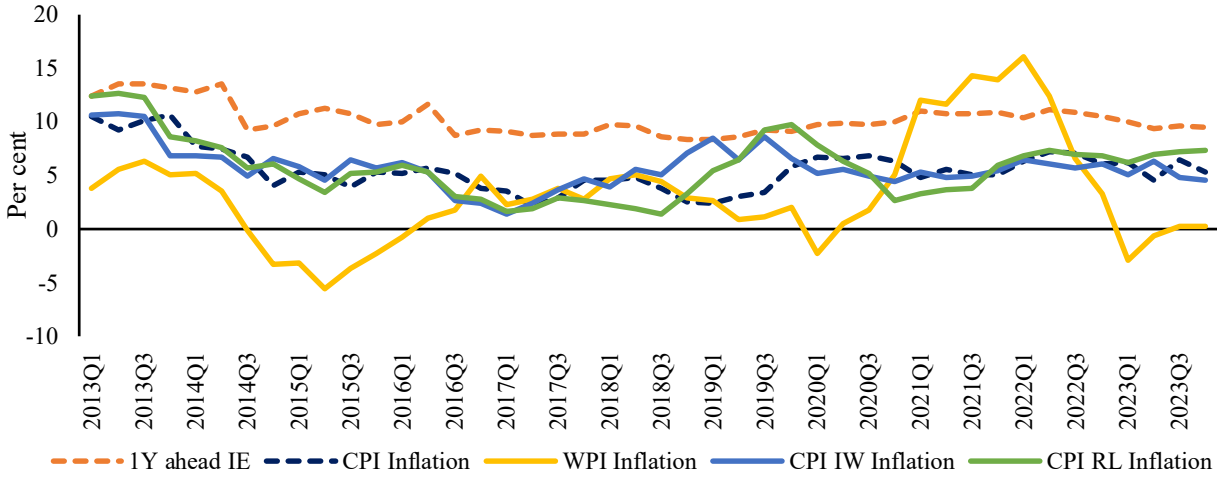
Note: Grey area indicates estimates not available due to data constraint.
Source: MOSPI and Authors' estimates.

The inflation dynamics in India highlight the dominance of food inflation in the CPI imparting higher volatility to the headline inflation path and often leading to transitory sectoral and state divergence. While transitory inflation shocks driven by supply factors can be better addressed by effective supply side policies, ascertaining the sources and nature of these shocks has to be in the ambit of monetary policy as its goal of price stability can be undermined by the de-anchoring of inflation expectations and the broadening of inflation pressures due to food price shocks (Patra et al. 2024a). As the paper pointed out, *'….wielders of monetary policy need to be conscious of the dangers of overkill in reactions to a transitory food price shock and also of the pitfalls of benign neglect of looking through persistent food price shocks'*. The next section, thus, delves into the aspect of the critical role monetary policy plays in containing inflation spirals and minimising the 'sacrifice ratio' in India with greater vulnerability to supply shocks.

4. Monetary Policy and the Flexible Inflation Targeting Regime

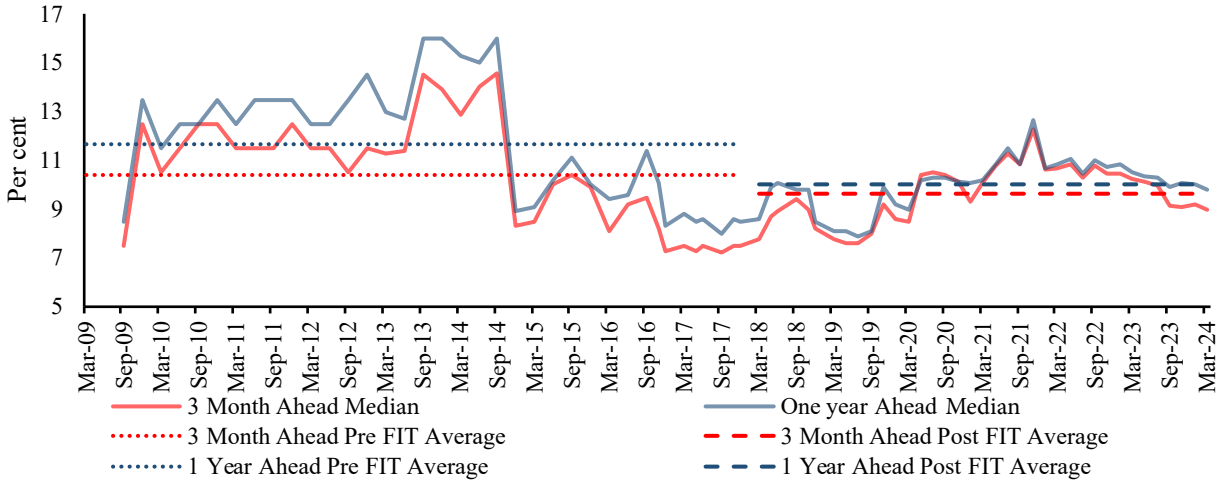
As noted earlier, the Reserve Bank of India formally adopted the flexible inflation targeting (FIT) framework in 2016-17 with the CPI as the nominal anchor and a target of 4% with a tolerance band of +/- 2%. A flexible inflation targeting with a tolerance band was warranted to accommodate high volatility in the food prices. In the case of India, threshold inflation in the long-run is estimated at 6%, beyond which it can be harmful to growth. The lower bound is set at 2% on the basis of the average inflation targets of major AEs which remained unchanged despite deflationary conditions (RBI, 2021). As part of this framework, the primary mandate of monetary policy is to maintain price stability while supporting growth. The FIT framework with CPI headline as the target measure has proven to be effective in keeping the inflation expectations anchored and stabilising inflation within the target band (Chart 12 and 13).

Chart 12: Inflation Expectations and Major Inflation Indicators



Source: MOSPI and RBI.

Chart 13: Inflation Expectations of Households



Source: RBI.

4.1 Relative Price Growth and Monetary Policy Challenges

While core inflation has remained relatively range bound, the main driver of headline inflation has been the growth in relative food prices (as a ratio of food CPI to non-food CPI) (Chart 14). If relative prices are large, persistent and not offsetting, they may affect monetary policy by influencing inflation expectations through second round effects (RBI, 2021).

Chart 14: Inflation and Change in Relative Food Prices

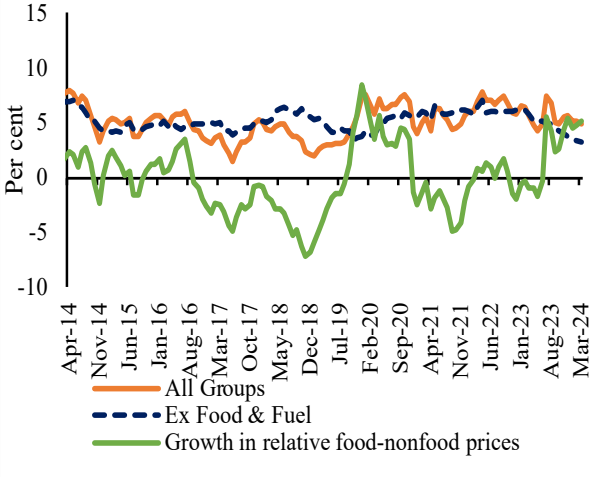
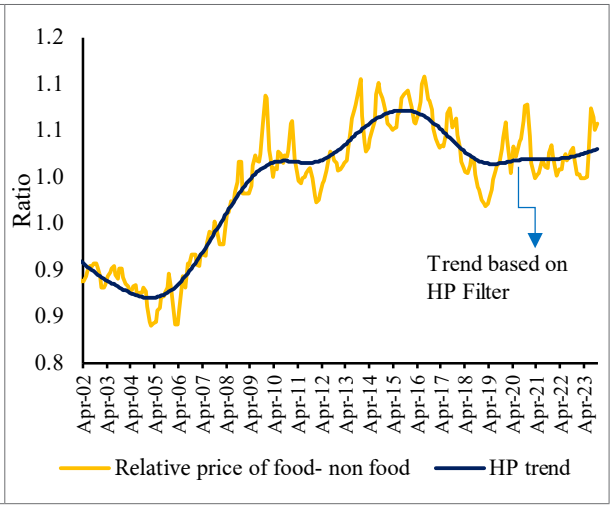


Chart 15: Relative Food Prices



Note: Relative food prices are the ratio of CPI food and Non-food indices.
HP trend is the standard trend and cyclical component derived from the Hodrick Prescott filter.
Source: MOSPI, Authors' estimates

The large weight of the food group in CPI and the associated high volatility in food prices pose greater challenges for effective implementation of the flexible inflation targeting in the short-run. In the long-run, changes in demand pattern and expenditure elasticity of the food basket can also make it difficult to predict food prices. In recent years, food prices have increased at a much faster pace than non-food prices owing to the increased frequency of extreme weather conditions, and higher global food prices emanating from increases in energy prices, transportation costs, and cost of fertilisers (Chart 15). As stated by Patra et al. (2024a), '*With its large share in the consumption basket, food inflation has the potential to affect headline inflation and it can also affect non-food inflation in the event of large and repeated food price shocks*'.

4.2 Sectoral Passthrough of Inflation

Given the recurrent episodes of elevated food prices, their spillover to core inflation and inflation expectations can result in generalisation of inflationary pressures. While Dholakia et al. (2018) has shown that in India, headline inflation reverts to core reflecting no generalisation of risk, Goyal et al. (2015, 2018) indicates the prevalence of bi-directional causality between headline and core and if food inflation remains high,

then core can revert to headline inflation. On similar lines, the transmission of sectoral inflation is assessed using a Granger causality test between core and non-core (headline excluding core, i.e., food and fuel) inflation with different lags on monthly inflation data from 2012 M04 to 2023M10 (Table 2).

Table 2: Causal Relation between Core and Non-core Inflation

Lag	Obs.	Core does not Granger Cause Non-core		Non-core does not Granger Cause Core	
		F-Statistic	Prob.	F-Statistic	Prob.
1	141	4.59***	0.03	0.70	0.40
2	140	3.00**	0.05	0.34	0.71
3	139	2.38*	0.07	1.25	0.30
4	138	1.71	0.15	1.09	0.37
5	137	1.99*	0.08	1.13	0.35
6	136	1.54	0.17	1.36	0.24
7	135	2.10**	0.05	1.49	0.18
8	134	1.87*	0.07	1.31	0.24
9	133	2.16**	0.03	2.30**	0.02
10	132	2.64***	0.01	2.14**	0.03
11	131	3.10***	0.00	2.93***	0.00
12	130	2.67***	0.00	2.90***	0.00

Note: ***,**,* denotes significance at 1%, 5% and 10% respectively.

The Granger causality (GC) of core and non-core corroborates the significance of the importance of a stable core inflation and low persistence of headline inflation as it shows a unidirectional causality from core to non-core inflation in the short-run. However, the notion that shocks to non-core inflation, dominated by food, are always transitory and monetary policy should 'look through' may alter the inflation path if the persistence of elevated non-core inflation over the longer term leads to spillover into core inflation as seen in the GC result which shows a significant bi-directional causality between core and non-core at the long lags. The risk of un-anchoring of inflation expectations due to persistence of elevated headline inflation can impact the core inflation path, warranting monetary policy actions. As Patra et al. (2024b) has emphasised, "*if food price pressures persist and continue to spill over, a cautious monetary policy approach is warranted. The conventional treatment of food price perturbations as transitory in the setting of monetary policy is increasingly becoming untenable. A large part of this increase in persistence is driven by the secular upward drift in food inflation expectations*".

4.3 Transmission of Shocks and Convergence

To further explore the spillover dynamics, the interaction between headline and core is analysed through an 'inflation-gap' model based on the following regression equation (Blagrave et al. 2020):

Convergence of headline inflation to core inflation:

$$\left(\pi_t^{headline} - \pi_{t-12}^{headline}\right) = \alpha_1 + \beta_1(\pi_{t-12}^{headline} - \pi_{t-12}^{core}) + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Convergence of core inflation to headline inflation:

$$(\pi_t^{core} - \pi_{t-12}^{core}) = \alpha_2 + \beta_2(\pi_{t-12}^{core} - \pi_{t-12}^{headline}) + \epsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The convergence analysis is based on monthly headline and core inflation data from 1990[5] M04 to 2023 M10 which estimates the convergence of headline to core (equation 1) and core to headline (eq. 2) 12-month ahead. A negative and statistically significant β would indicate convergence as in eqn. (1) which reflects a fall in headline and convergence to core, when it is higher than core. Eqn. (2) checks convergence of core to headline.

Table 3: Transmission of Shocks to Headline and Core Inflation

Convergence of Headline to Core inflation			
Dependent variable: $(\pi_t^{headline} - \pi_{t-12}^{headline})$	Full Sample (1990 M04-2023 M10)	Pre-FIT (1990 M04-2016 M08)	Post-FIT (2016 M09- 2023M10)
constant	-0.01 (0.36)	0.02 (0.44)	-0.25 (0.33)
$(\pi_{t-12}^{headline} - \pi_{t-12}^{core})$	-0.83*** (0.25)	-0.79*** (0.29)	-1.06*** (0.19)
Convergence of Core to Headline inflation			
Dependent variable: $(\pi_t^{core} - \pi_{t-12}^{core})$			
constant	-0.18 (0.28)	-0.27 (0.35)	0.16 (0.21)
$(\pi_{t-12}^{core} - \pi_{t-12}^{headline})$	-0.19 (0.18)	-0.20 (0.21)	-0.23 (0.16)
No. of Observations	403	317	86

Note: ***,** and * denote significance at 1%, 5% and 10% respectively; Figures in parentheses are standard errors.

5. Since the data on Combined CPI series is available from 2010, the back series has been computed using the available CPI for Industrial Workers which shows significantly close co-movement with the former.

The results show that for the full sample period the convergence of headline to core is significant, while no core to headline convergence is seen, indicating transitory deviations in headline inflation (Table 3). A further sub-sample analysis of the inflation gap model into pre- and post-FIT period provides an interesting observation. While the convergence from headline to core has been significant in both pre- and post-FIT period, the pace of convergence has increased in the post-FIT period, which could be a reflection of an increased degree of anchoring of inflation expectations. There is, however, no significant convergence of core to headline observed in both these periods. While the contemporaneous relation does not show any impact of headline on core, the GC results indicate some causality in the long-run.

4.4 Anchoring of Inflation Expectations in the FIT Regime

The effectiveness of India's FIT regime in anchoring inflation expectation is further examined in the following three ways. The first model analyses the relative impact of the core and non-core inflation print on the one-year ahead mean expectations and whether they have significantly changed in the post-FIT period. In this model, a well anchored inflation expectation is likely to be more influenced by the stable core than the volatile non-core inflation. The second model analyses the dependence of longer-term inflation expectations on short-term expectations. The effectiveness of FIT is seen with the impact of movement in short- term inflation expectation on the medium-term which is expected to be lower if the inflation expectations are better anchored. Finally, the third model analyses the impact of deviation of headline inflation from its target following Moessner et al. (2020). The post FIT impact is expected to capture the stability of the expectations when inflation deviates from its target. In order to analyse anchoring from these perspectives, the following regression equation is used for each inflation print based on Lyziak et al. (2016) and Goyal et al. (2019). Since the anchoring of expectations may strengthen over time, the model divides the entire sample into two sub-samples, separated by the FIT adoption in India as given below:

$$\pi^{e}_{t+4/t} = \rho\pi^{e}_{t+3/t-1} + (1-\rho)\{(1-FIT) * (\alpha_1 + \beta_1\pi_{ti\ i}) + FIT * (\alpha_2 + \beta_2\pi_{ti}\ )\} + \varepsilon_t \quad \ldots (3)$$

The equation considers one year ahead inflation expectations $\pi^{e}_{t+4/t}$ as a function of its own lag to capture persistence and π_{ti} which indicates i^{th} dependant variable in the t^{th} period. The sub-samples, capturing the pre- and post-FIT regime are indicated by the FIT dummy which takes 1 for the post-FIT period and 0 otherwise. The model is used for different specifications with core (*Core_inflation)* and non-core (derived as headline excluding core) inflation (*Non-Core_inflation*) as exogenous variables in the first two specifications. The third and fourth specifications consider 3-month ahead inflation expectations (*IE_3month ahead)* and the deviation of headline from the target *(Headline Inflation – target)* (inflation target is 4%). In this equation ρ captures the persistence of IE and β_1 and β_2 capture the pre- and post-FIT significance of these inflation prints on

one year ahead IE. In order to test for the difference in the estimated parameters of the pre- and post-FIT period, the Wald test is applied which tests the null hypothesis in a parametric model:

$$H_0 : \beta_1 = \beta_{2,}$$

against the alternative hypothesis, $H_1 : \beta_1 \neq \beta_2$

which captures any significant difference in the impact in the pre- and post-FIT period. The post-estimation diagnostics confirmed absence of serial correlation and heteroscedasticity.

Table 4: Anchoring of Inflation Expectations

Dependent variable IE_One Year	ρ	β_1 *(Pre-FIT)*	β_2 *(Post-FIT)*	*Adjusted* R^2	*Wald Test* $\beta_1 = \beta_2$ (F statistics)
Inflation prints on 1year ahead IE:					
Core_inflation	0.84*** (0.05)	0.22*** (0.07)	0.29*** (0.10)	0.67	2.89*
Non-core Inflation	0.73*** (0.04)	0.08*** (0.03)	0.08** (0.08)	0.64	0.001
3month ahead IE on 1year ahead IE:					
IE_3month ahead	0.13*** (0.04)	0.94*** (0.03)	0.62*** (0.08)	0.94	14.44***
Deviation of inflation from target on 1 year ahead IE					
(Headline Inflation – target)	0.70*** (0.09)	0.14** (0.07)	0.20 (0.13)	0.66	0.2

Note: ***, **, *: - significance at 1%, 5% and 10% respectively; Figures in parentheses are standard errors.
Source: Authors' estimates.

The first model shows that while core inflation dominates, non-core inflation also continues to influence expectations, *albeit,* at a lower level, strengthening the case for targeting the headline rather than the core inflation as indicated in the bidirectional causality in the GC model (Table 4). The improved anchoring is also reflected in the falling influence of 3-month ahead expectations on one-year ahead expectations in the post-FIT period. However, while the magnitude has moderated, there is still significant influence of the short-term expectations, indicating room for improvement in anchoring expectations. Finally, the absence of any impact of the deviation of headline inflation from the target on one year ahead expectations in the post-FIT period which suggests an improvement in anchoring in the FIT regime, corroborates the findings of the first two specifications.

5. Conclusion

The Indian economy has remained resilient with robust growth and progressive alignment of inflation to the target. Setting price stabilisation as the primary objective, the Reserve Bank of India adopted the FIT regime in 2016-17 with CPI as the nominal anchor and target of 4% with +/- 2% band. This paper examines the Indian experience with inflation management in the FIT regime.

Inflation has been quite diverse across states, with high inflation states witnessing wider rural-urban inflation gap. The share of food in the consumption basket has been one of the primary factors for this divergence in both rural and urban sectors across states. There is, however, no evidence of inflation persistence across the majority of the states, barring a few remote states.

The empirical analysis suggests that the FIT regime strengthened monetary policy credibility and anchoring of inflation expectations. The presence of unidirectional causality from stable core to non-core inflation in the short-run indicates a tendency of headline inflation to converge towards core despite sporadic volatility from food prices. However, persistent food inflation may impact core inflation in the long-run, as indicated by the bi-directional causality between core and non-core with longer lags. The analysis also indicates that there is not only significant convergence of headline to core, but the pace of convergence has also increased significantly in the post-FIT period. Furthermore, while core has significant impact, non-core inflation also has influence on expectations, highlighting the need for targeting headline for stabilising inflation. The improved anchoring of inflation expectations in the post-FIT regime is also indicated in the reduced effect of short-term expectations on medium-term expectations and these expectations are not being significantly impacted by deviations from the target. Overall, the FIT regime has fared well in stabilising inflation and inflation expectations since its adoption, although recurrent large food price shocks pose continuing challenges to the conduct of monetary policy.

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Annex

Annex 1: Major Price Indices in India

Sl No.	Feature	CPI (IW)	CPI (AL)	CPI (RL)	Combined CPI (Rural+Urban)	WPI
1	Data compiled and released by	Labour Bureau, Ministry of Labour	Labour Bureau, Ministry of Labour	Labour Bureau, Ministry of Labour	NSO, MoSPI	OEA, Ministry of Commerce
2	Source of Weights	Family Living Survey, NSO, 1999-2000	Consumer Expenditure Survey, NSS 38th Round (1983)	Consumer Expenditure Survey, NSS 38th Round (1983)	Consumer Expenditure Survey, NSS 68th Round (2011-12)	As per Gross Value of Output
3	Base year of the series	2016	1986-87	1986-87	2012	2011
4	Number of items in the basket	Field Officers of Directorate/ Bureau of Economics and statistics of Labour Departments	Field Officers of NSO	Field Officers of NSO	Officers of Department of Posts	Online Surveys and through various ministries
5	Index released for	78 centres and all India	20 states and all India	20 states and all India	All States/UTs and all India	Single all India
6	Periodicity of Index	Monthly	Monthly	Monthly	Monthly	Monthly

Source: MOSPI and ILO.

Annex 2: Comparative Statement of Weights assigned to WPI Product Groups

Major Groups/Groups	1970-71	1981-82	1993-94	2004-05	2011-12
All Commodities	**100**	**100**	**100**	**100**	**100**
Primary Articles	**41.667**	**32.295**	**22.025**	**20.118**	**22.618**
Food Articles	29.799	17.386	15.402	14.337	15.256
Non-Food Articles	10.621	10.081	6.138	4.258	4.119
Minerals	1.247	4.823	0.485	0.623	0.833
Crude Petroleum & Natural Gas	-	-	-	0.900	2.410
Fuel and Power	**8.459**	**10.663**	**14.226**	**14.910**	**13.152**
Coal	-	1.256	1.753	2.094	2.138
Mineral Oils	-	6.666	6.987	9.364	7.950
Electricity	-	2.741	5.484	3.452	3.064
Manufactured Products	**49.874**	**57.042**	**63.749**	**64.972**	**64.230**
Food Products	12.322	10.143	11.538	9.974	9.122
Beverages	2.708	2.149	1.339	1.762	0.909
Tobacco Products	-	-	-	-	0.514
Textiles	11.026	11.545	9.800	7.326	4.881
Wearing Apparel	-	-	-	-	0.814
Leather and Related Products	0.385	1.018	1.019	0.835	0.535
Wood and Products of Wood and Cork	0.174	1.198	0.173	0.587	0.772
Paper and Paper Products	0.851	1.988	2.044	2.034	1.113
Printing and Reproduction of Recorded Media	-	-	-	-	0.676
Chemical and Chemical Products	5.548	7.355	11.931	12.018	6.465
Pharmaceuticals, Medicinal Chemical and Botanical Products	-	-	-	-	1.993
Rubber and Plastics Products	1.207	1.592	2.388	2.987	2.299
Other Non-Metallic Mineral Products	-	-	-	2.556	3.202
Basic Metals	5.974	7.632	8.342	10.748	9.646
Fabricated Metal Products, Except Machinery and Equipment	-	-	-	-	3.155
Computer, Electronic and Optical Products	-	-	-	-	2.009
Electrical Equipment	-	-	-	-	2.930
Machinery and Equipment	5.045	6.268	8.363	8.931	4.789
Motor Vehicles, trailers and Semi-Trailers	1.673	2.705	4.295	5.213	4.969
Other Transport Equipment	-	-	-	-	1.648
Furniture	-	-	-	-	0.727
Other Manufacturing	0.546	0.972	0.000	0.000	1.064

Source: Office of Economic Advisor, Ministry of Commerce, Government of India.

Annex 3: Comparative Statement of Weights Assigned to CPI Product Groups

	Old Series of CPI			Revised Series of CPI		
Basis for weight computation	**CES 2004-05**			**CES 2011-12***		
Major Groups/Sub-Groups	**Rural**	**Urban**	**Combined**	**Rural**	**Urban**	**Combined**
Food and beverages	56.59	35.81	47.58	54.18	36.29	45.86
Pan, tobacco and intoxicants	2.72	1.34	2.13	3.26	1.36	2.38
Clothing and footwear	5.36	3.91	4.73	7.36	5.57	6.53
Housing	-	22.54	9.77	-	21.67	10.07
Fuel and light	10.42	8.40	9.49	7.94	5.58	6.84
Miscellaneous	24.91	28.00	26.31	27.26	29.53	28.32
Total	**100**	**100**	**100**	**100**	**100**	**100**

**:* NSO has released the Household Consumption Expenditure Survey (HCES), 2022-23. The CPI base revision is not available yet.

Source: Ministry of Statistics and Programme Implementation, Government of India.

CHAPTER 4

INTRODUCING KOREA'S CONSUMER PRICE INDEX

By
Hyun Seok Jeong
Bank of Korea

1. Overview of the Consumer Price Index

Korea's Consumer Price Index (CPI) is compiled by the Statistics Korea. In Korea, the CPI is developed through surveys conducted in selected stores. Based on factors like population and sales volumes, 40 cities are chosen. These cities are then divided into 155 survey areas, considering the distribution of commercial zones. Surveyors select target locations within these areas, believed to represent the population well, based on user numbers and awareness. The surveys are primarily conducted by officials from the Statistics Office.

Data collection usually involves visiting the selected locations for face-to-face interviews. However, depending on the nature of the items being surveyed, phone, fax, and internet surveys are also used. For items with a national standard price, central surveys are conducted through interviews, phone calls, and the internet by the headquarters.

2. Representative Items

The CPI consists of 458 items. They can more accurately be described as a collection of items. An "item" refers to the smallest unit for which individual indices are published. Some are single items like rice or ramen, while others, like frozen foods, leisure goods, and sports equipment, include multiple items.

There are three criteria for selecting representative items: 1) the item must account for a certain percentage of the average monthly household consumption expenditure, 2) it should represent the price of a similar category of items, and 3) it must be possible to continuously survey the prices in the market.

Representative items can be divided into 12 major categories based on the consumer's purpose of purchase. Items are replaced every five years to ensure the index reflects reality. Items with a higher expenditure share are added, while those with a lower share are removed. In 1965, the number of representative items surveyed by base year was 284 items, and this number has gradually increased, and maintained at between 400 and 500 items currently.

3. Research About Price

Every month, staff from the Statistics Korea visit or call around 26,000 retail outlets nationwide, including department stores, supermarkets, and traditional markets, to collect price data.

The CPI survey takes place in 40 cities across the country, selected based on population size and commercial areas. Within these cities, a certain number of retail stores where people frequently shop are chosen. Some items are surveyed without direct visits. For example, petroleum products like gasoline, diesel, and automotive LPG are surveyed by collecting prices from petroleum-related public organisations instead of visiting each location. This makes the survey more efficient. Price collection typically occurs once a month during a set period. However, for items like agricultural, livestock, and fishery products, as well as petroleum products, which can experience significant price fluctuations within a month, prices are surveyed three times a month and averaged. When collecting prices, the actual transaction price paid by consumers is surveyed, including taxes like VAT included in the product price. If the government provides subsidies for a product, the amount paid by households excluding the subsidy is surveyed.

4. Weights

When combining the price changes of the 458 items surveyed for the Consumer Price Index (CPI), a simple average would not reflect the many impacts of each item on consumers' daily lives. For example, a 10% increase in the price of rice versus a 10% increase in the price of bean does not have the same effect on household consumption. Therefore, item-specific weights are created based on the average monthly expenditure share of each item. This weighted average ensures that the CPI reflects the impact on expenditure size.

We will discuss how the relative importance of representative items is calculated. The overall CPI represents the weighted average of the prices of representative items, meaning each item influences the overall index according to its relative importance. This importance is determined by the item's share in the total household expenditure, which becomes the item's weight in the CPI. For example, if households spend three times more on rice than on eggs, a 10% price increase in both would have three times more impact from rice on the inflation rate. These weights are assigned to each representative item, with the total sum of weights being 1,000.

To determine the weights, the Statistics Korea's "Household Trends Survey," which examines the consumption structure of Korean households, is essential. This survey provides insight into the expenditure share of each item within households. The current weights are based on 2022 data. On December 19, 2023, the Statistics Office updated the weights from the 2020 base to 2022. The highest weights are for housing, water, electricity, and fuel at 171.6 out of 1,000, followed by food and lodging at 144.7, and food and non-alcoholic beverages at 142.

5. Data Processing

First, the 458 survey items are coded. This is done using the Classification of Individual Consumption According to Purpose (COICOP), a standard used by international organisations like the UN and OECD for categorising consumer expenditures into 12 sub-categories. An example of coding items is as follows:

Once items are coded, data is entered by surveyors using tablets to input the survey locations and prices. When entering prices, a re-verification message may appear if there's a potential input error. Data submission is possible only when there are no logical inconsistencies, such as mismatched prices and codes or missing entries.

Errors are verified as follows: First, check for non-responses, which can occur if a business has closed or changed its industry. In such cases, it may be necessary to replace the sample. To minimise errors while replacing samples, prices from the previous month or prices from different areas within the same city are used as substitutes.

6. Making an Index

To construct the index based on the collected data, we use mathematical formulas. In Korea, the Consumer Price Index (CPI) employs the Laspeyres formula, which uses the base period's weights. The Laspeyres formula is defined as the weighted arithmetic mean of price ratios using the weights from the base period.

On the other hand, the Paasche formula applies the weights from the comparison period. There are various types of formulas, each with its advantages and disadvantages.

We will go through a simple example to understand the calculation process of the Consumer Price Index (CPI).

The process begins by creating item indices for each city, then applying city-specific weights to generate a national item index. Next, national item indices are weighted by item to calculate the overall national CPI.

7. Use of the Consumer Price Index

The Consumer Price Index (CPI) serves various purposes and has a significant impact on government, businesses, and the daily lives of citizens.

As an economic indicator, the CPI is crucial for assessing the economy's condition. Generally, prices tend to rise during economic upturns due to increased demand and fall during downturns due to decreased demand. The government uses the CPI, along with other macroeconomic indicators, to diagnose the state of the economy and, when necessary, to formulate fiscal and economic policies.

The CPI also measures the purchasing power of money. Inflation reduces the quantity of goods that can be bought with the same amount of money, decreasing money's value. To maintain the same purchasing power, various payments like national pensions and minimum living expenses are periodically adjusted. The CPI is used to convert the value of money from a specific point in the past to its current value, reflecting changes in purchasing power.

Furthermore, the CPI is used as a target figure for monetary policy. The Bank of Korea, the country's central bank, adopts an inflation targeting regime as its monetary policy framework. This approach sets a specific target for inflation and aims to achieve it over the medium-term. As of 2024, the Bank of Korea's medium-term inflation target is set at a 2.0% annual increase in the CPI.

8. Bank of Korea's Inflation Stabilisation Target System

In Korea, the way the central bank controls money involves a clear plan for keeping prices steady. Every three years, the Bank of Korea and the government agree on a specific goal for this. The Bank then makes sure the actual increase in prices matches this goal. It also tries to meet people's expectations for prices to stay stable, which helps decide the cost of items.

At first, in 1998 and 1999, the Bank of Korea focused on the Consumer Price Index (CPI), which is a way to measure how prices change over time. The CPI was chosen because it's easy to comprehend and also in consultation with the International Monetary Fund (IMF), which was already using the CPI to predict future price changes. Using a different measure may have been confusing to people.

Starting in 2000, the Bank began focusing on "core inflation" as their main measure. Core inflation looks at the long-term trend in prices without the ups and downs of food and energy costs. This was thought to be a good way to guide their decisions on how to control money. However, core inflation does not include the costs of food and oil, which are very important in people's daily expenditure. Since this indicator did not reflect the true condition, the Bank of Korea decided to go back to using the CPI as their main measure in 2007.

CHAPTER 5

INFLATION MEASUREMENT AND ITS IMPLICATION FOR MONETARY POLICY: THE CASE OF LAO PDR

By

Project Team Members

from Bank of the Lao PDR[1]

1. Introduction

The Lao People's Democratic Republic or Lao PDR is a developing country located in Southeast Asia (SEA) with a population of roughly 7.544 million (Lao Statistics Bureau, 2022). Laos is the only landlocked country in SEA. It is bordered by China, Vietnam, Cambodia, Thailand and Myanmar. Laos has major trading partners such as Thailand, Vietnam, and China, accounting for over 85% of the trade volume. Its primary sources of exports are electrical energy, mines and agricultural products while the main imports include petroleum oils, mechanical equipment, manufactures, iron and steel products.

Lao PDR gained its independence which was officially declared on 2 December 1975. One of the significant periods of economic development in Laos is the establishment of the New Economic Mechanism (NEM) in 1986, which has contributed to subsequent decades of high GDP growth (about 6.5% on average with the peak of around 8.6% in 2006). Under NEM, a number of significant reforms have been made to transition the economy from a central planning to a market-oriented one (Srithilat, et al., 2017). These included the promotion of property rights and privatisation, the financial reform based on the market adapted system, openness and exposure to international competitiveness, institutional reforms, change in tax and budget policy and macroeconomic management, as well as price reform to reflect the markets (Bourdet, 1994). Despite a high GDP growth, inflation has been largely kept under control except during the Asian Financial crisis (AFC) when inflation surged to the highest levels ever recorded (91% in 1998 and 125% in 1999)[2] and the recent episodes of high inflation during the COVID-19 pandemic. Just like many other countries, the Lao economy has been significantly affected by the recent pandemic. While it is currently on the path to recovery, the lingering effects of the pandemic continue to impact the present economic situation. Following decades of low and stable inflation, Laos has been challenged with the episodes of high inflation beginning in mid-2022. This

1. Project team members comprise Dr. Sompasong Phommasane, Deputy CEO of Banking Institute (BI); Mr. Ananthala Nakhiengchan, the Head of Finance Sector; Ms. Souphaphone Houathongkham, Technical staff of Banking Institute; Mr. Amnuay Vongdonedaeng, Technical staff of Banking Institute; Ms. Sayfone Soudthavy, Technical staff of Monetary Policy Department; and Ms. Sommay Heuankeomany, Technical staff of Monetary Policy Department.

2. Source: World Bank.

surge was primarily driven by global supply chain disruptions, which led to significant increases in global energy and food prices. As a result, inflation escalated to double digits for the first time since the Asian Financial Crisis, reaching 41.26% in February 2023. Since that peak, inflation has gradually decreased, with a current rate of 26.08% recorded in July 2024[3]. The Bank of the Lao PDR, the country's Central Bank, considers price stability as its primary objective and has implemented a series of tight monetary policy measures to address the high inflation. To address rising inflation, the Bank of the Lao PDR has deployed a range of monetary policy tools, including raising interest rates, increasing reserve requirement ratios, and issuing bills to manage money supply. These measures are implemented in conjunction with the exchange rate policy as well as aligned with the government's fiscal policy directions. However, due to Laos's import dependency and structural economic challenges, controlling inflation remains a complex task. The Central Bank remains committed to combating inflation in order to restore a low and stable inflation environment.

Inflation dynamics in Laos involves both external and internal factors. The external factors include global oil prices, exchange rate movements, imported food and consumer prices from overseas, primarily Thailand as its top trading partner. Moreover, Lao PDR can be susceptible to external shocks as demonstrated in the recent years by the impacts of the COVID-19 pandemic, geopolitical conflicts and trade restrictions, which can affect the prices in Laos. Internal factors include money supply and exchange rates, which fluctuate depending on external forces and the movement of the strong currencies such as the USD and BAHT. Additionally, Laos' structural weakness including its industrial base still in its early stages of development and its agricultural dominance in which weather conditions such as floods and droughts significantly affect agricultural produces, play a role in the supply of goods and services, hence affecting the prices in Laos. Inflation in Laos is primarily measured by the Consumer Price Index (CPI), which is collected by the Lao Statistics Bureau under the Ministry of Planning and Investment. It is divided into 12 categories including food and non-alcoholic beverages; alcoholic beverages, tobacco and narcotics, clothing and footwear; housing, water, electricity, gas and other fuels; furnishings, household equipment and routine household maintenance; health; transport; communication; recreation and culture; education; restaurants and hotel and other miscellaneous goods and services.

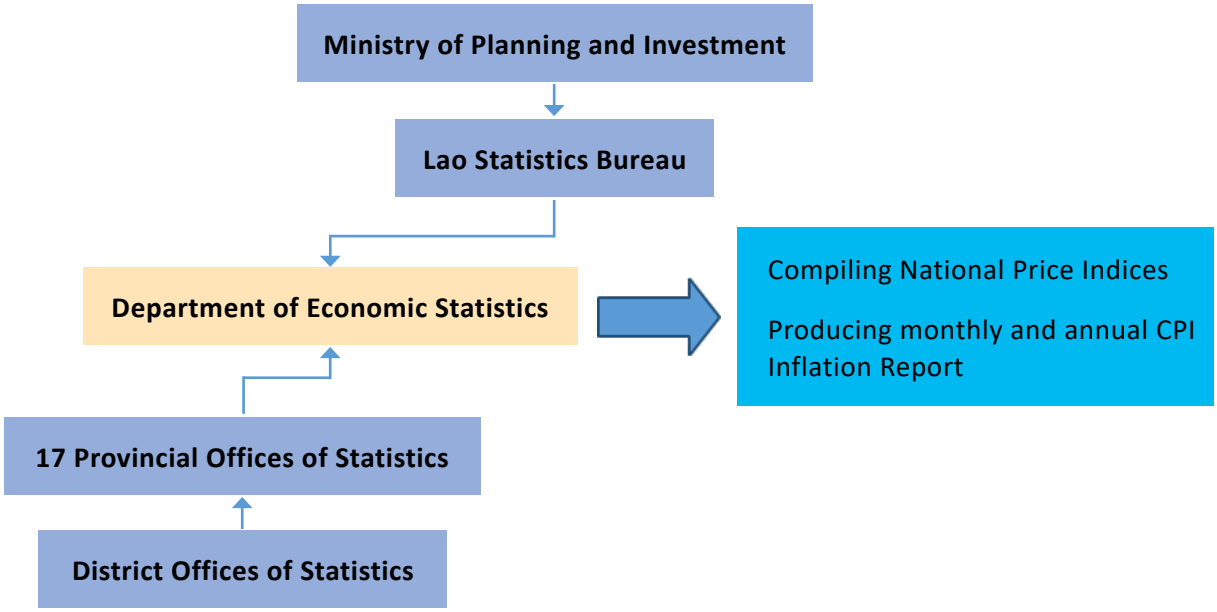
This case study focuses on the inflation measurement in Laos, outlining the general overview of the data collection process, the methodology, the plans for development in improving the CPI inflation measurement, drivers of inflation and recent monetary policy responses. The paper will also discuss some limitations and areas for improvement.

3. Source: Lao Statistics Bureau.

2. Inflation Measurement in Laos

2.1 Consumer Price Index (CPI) Data Collection Agency

The Lao Statistics Bureau (LSB) under the Ministry of Planning and Investment (MPI) is responsible for compiling official and national Consumer Price Index (CPI) data. Within LSB, the Department of Economic Statistics (DoES) oversees the compilation process. National price indices are submitted by the provincial statistics offices, which gather data from district offices. The final monthly and annual inflation reports are published on the official website[4] of LSB.



2.2 Evolution of CPI Data Collection

The history of CPI data collection in Lao PDR began with the Bank of the Lao PDR (BOL), the Central Bank of Laos. BOL was the pioneer in collecting price data between 1988-1996 and calculated the CPI using December 1987 as the base year. However, the data collection was limited to only Vientiane Capital, the capital city of the country, with only 70 items from five categories. In 1995, the Lao Statistics Bureau (LSB) assumed responsibility in compiling the monthly CPI based on the Lao Expenditure and Consumption Survey (LECS). The first LECS survey was conducted in fiscal year 1992/1993, and collected price data for a basket of 129 items from only one province, Vientiane Capital. The result was used to establish the CPI weights with 12/1995 as the base year.

4. https://laosis.lsb.gov.la/

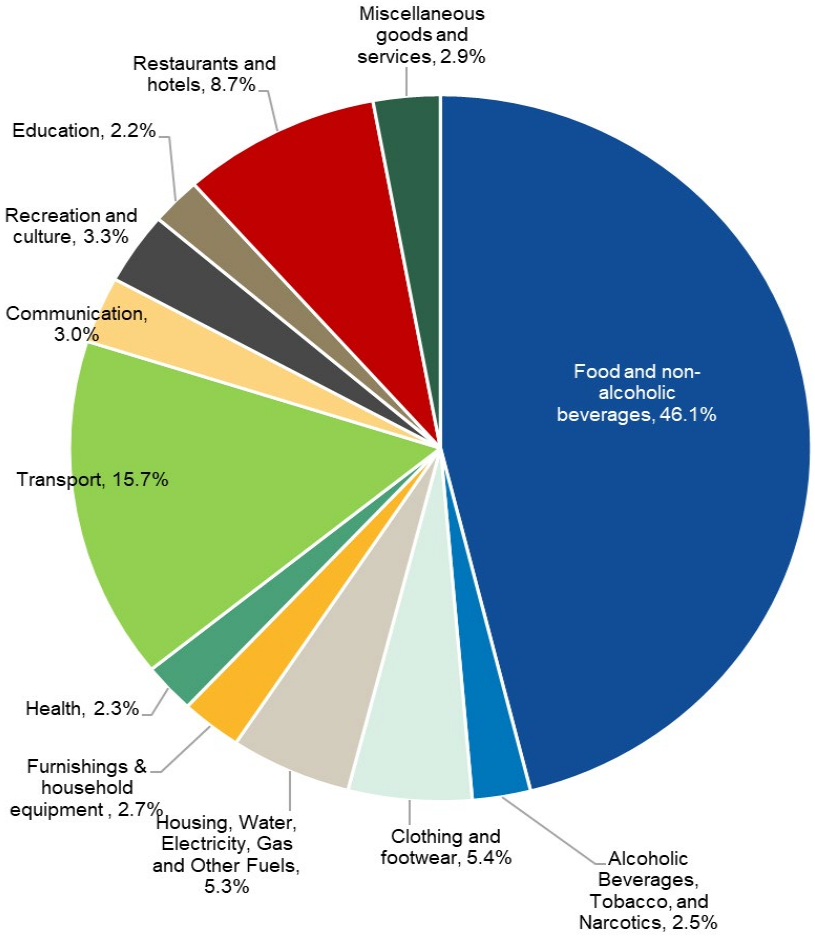
From 1997-1998, the second LECS (LECS II) was undertaken for which the CPI weights and base year of 12/1999 were sourced, covering a basket of 197 items from 5 provinces. Between 2002-2003, the third LECS (LECS III) was launched, and its findings were used to determine the CPI weights with 12/2005 as the base year. 181 items were incorporated into the CPI basket across 8 provinces. During 2007-2008, LECS IV was implemented from which the results of the survey were used to establish the CPI weights in 2010 with the basket consisting of 245 items from 12 provinces. From 2012-2013, LECS V was completed, and the new CPI weights were formulated by using December 2015 as the base year. It was a significant improvement from the previous period with more items being added, covering 485 items across almost all provinces in Laos, amounting to 17 provinces in total, with the exception of Xaysomboun province.

Between 2018-2019, LECS VI was implemented, but the current weights of CPI used to measure inflation are still based on LECS V with 485 items, 17 provinces and 22 markets across 12 sub-categories. The improvement on the weights, items and coverage is underway to better capture price changes in Laos.

3. Methodology

3.1 Source of Weights

Three main categories with the most weights are Food and Non-Alcoholic Beverages (46.09%), Transport (15.66%) and Restaurants and Hotels (8.65%). The current weights are sourced from LECS V since 2012/2013. LEC V was the fifth national survey of national expenditure and consumption, which was designed to measure the poverty level at the national and provincial scale. A total of 8,226 households were selected based on their locations within the provinces and villages, whether it is urban, rural with roads or rural without roads. Households from 515 villages across 17 provinces (except Xaysomboun province) participated in the survey. The sample was chosen using a two-stage sampling process. In the first stage, villages were selected randomly based on their population size. In the second stage of sampling, 16 households from each of the 515 villages were selected. Eight households were chosen randomly from those included in the LECS IV survey (previous survey), while the other eight were selected randomly from the list of all households in the village.



Out of the 485 items surveyed for price indices, Food and Non-Alcoholic Beverages category holds the most items (143), followed by Furnishings, Household Equipment and Routine Household Maintenance (81); and Clothing and Footwear (49).

According to the Monthly Inflation Report published by the LSB, the Core CPI is defined as price level of items that are observed to have normal trend and not highly volatile. They make up 402 items (82.9% total coverage) with distributed weights of 55.6%. On the other hand, Non-core CPI is defined as highly volatile goods and services such as raw food, electricity, gas, fuel and gold jewelry. There are 83 items (17.1% total coverage) with distributed weight of 44.4%.

Two further sub-categories of CPI indices are identified in the monthly inflation report published by the LSB. These are indices for domestically produced goods and imported goods. The domestic goods cover 230 items, about 47.4% of the total items in the basket with distributed weight of 69.3% whereas the imported goods consist of 255 items, about 52.6% of the basket with distributed weight of 30.7%.

12 Categories	Item coverage[5]	Weights
Food and non-alcoholic beverages	143	46.09%
Alcoholic beverages, tobacco, and narcotics	16	2.54%
Clothing and footwear	49	5.39%
Housing, water, electricity, gas and other fuels	27	5.28%
Furnishings, household equipment and routine household maintenance	81	2.66%
Health	18	2.27%
Transport	42	15.66%
Communication	13	3.05%
Recreation and culture	27	3.30%
Education	14	2.19%
Restaurants and hotels	22	8.65%
Miscellaneous goods and services	33	2.92%
Total	485	100.00%

Description of Key CPI Price Indices	Items Coverage	weights
Core CPI	402	55.6%
Non-core CPI	83	44.4%
Domestic Goods	230	69.3%
Imported Goods	255	30.7%

3.2 Calculation of CPI Index

According to the Dissemination Standards Bulletin Board (DSBB) of the International Monetary Fund (2018), the compilation of CPI of Lao PDR is based on the methodology that has been developed in accordance with the International Labour Organisation's (ILO) and IMF's suggestion. Nevertheless, a staff member in Department of Economic Statistics reported that LSB practices the methodology of computing CPI data based on the general standard formula recommended by the IMF, which is the Laspeyres index formula, an arithmetic concept with fixed basket of goods and services at the base period of December/2015.

5. According to the 2017 Price Catalog Technical Notes supplied by LSB.

3.3 Price Collection Procedure

- **Classification:** LSB follows the Classification of Individual Consumption according to Purpose (COICOP). For the purpose of compilation of CPI, an 8-digit COICOP code is used, while for the purpose of dissemination, a 2-digit COICOP code is used.

- **Basis for recording:** Purchaser prices are focused on in the compilation of the CPI index. Staff members of provincial and district offices are responsible for collecting the three purchaser prices of the same items from the selected market. An average of the three purchaser prices are obtained to establish the monthly CPI. Data collection is done manually rather than using technological devices such as tablets. During the COVID-9 period in 2020-2022, it was reported that the price survey questions and catalogues were sent to the select sample outlets, with staff of statistical offices at the district collecting those prices. Verification is done with Microsoft Excel function of threshold by setting minimum and maximum prices of each item. If prices are keyed incorrectly and exceed the threshold, staff will be alert and double check those items with the outlets.

- **Period and items of monitoring and recording:** According to the 2017 Price Catalogue Manual provided by LSB, which it still uses currently, 76 items that are considered price sensitive and highly volatile are monitored on a weekly basis; 107 items are monitored on a monthly basis; 201 items are monitored on a quarterly basis and 101 items are monitored on a semi-annual basis (every six months)

- **Reporting process:** Between 1-5th of each month, provincial offices would collect price data. From 16-20th, the collected data is submitted to the Department of Economic Statistics at the LSB in Vientiane Capital. From 21-24th, LSB at the central level compiles the national CPI indices and verifies the data with the provincial offices if needed. Also, during this time, LSB regularly conducts a monthly CPI group meeting with line ministries primarily Bank of Lao PDR and the Ministry of Commerce to discuss the preliminary results, relevant policy measures and finally agree on the report. By the 25th of each month, the monthly national CPI report is officially released.

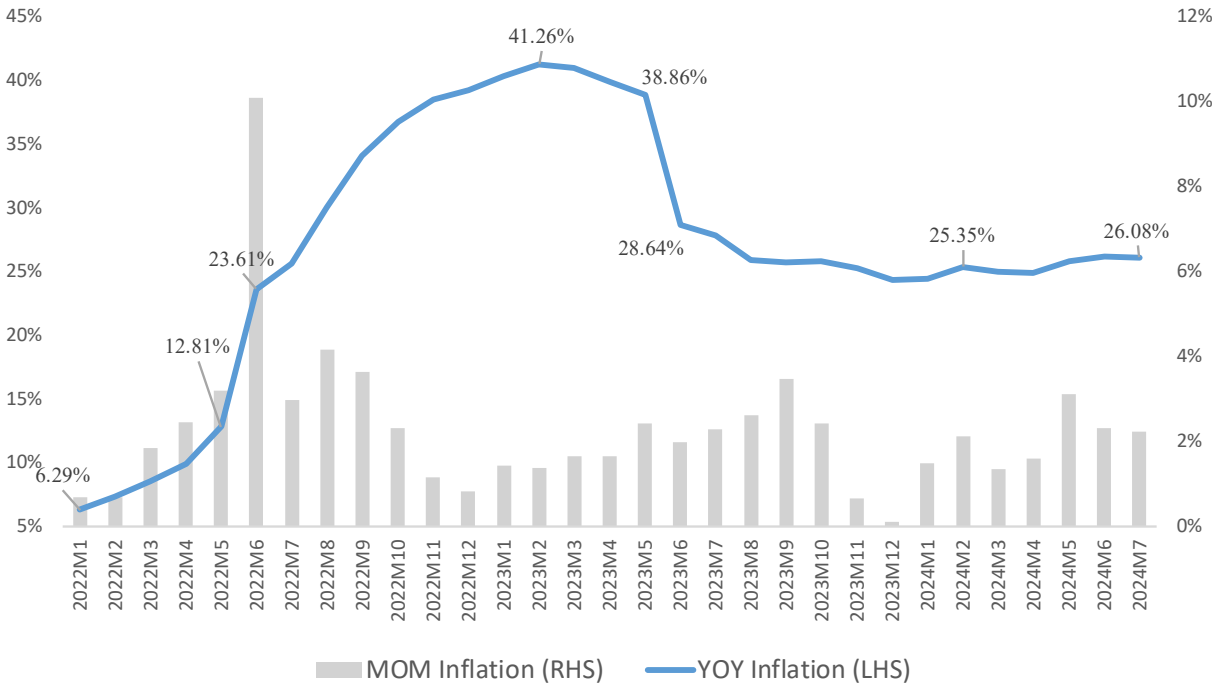
- **Publication and periodicity:** LSB publishes monthly and annual inflation reports through both the online platform as well as physical copies which are sent regularly to relevant agencies within scope of responsibilities and as per request. The online platforms include its official web page (www.lsb.gov.la) and the Dissemination Standards Bulletin Board (DSBB) of the IMF. The Bank of the Lao PDR also publishes the price data on the BOL official website but only the national inflation rate, not the 12 categories of CPI indices.

4. Drivers of Inflation

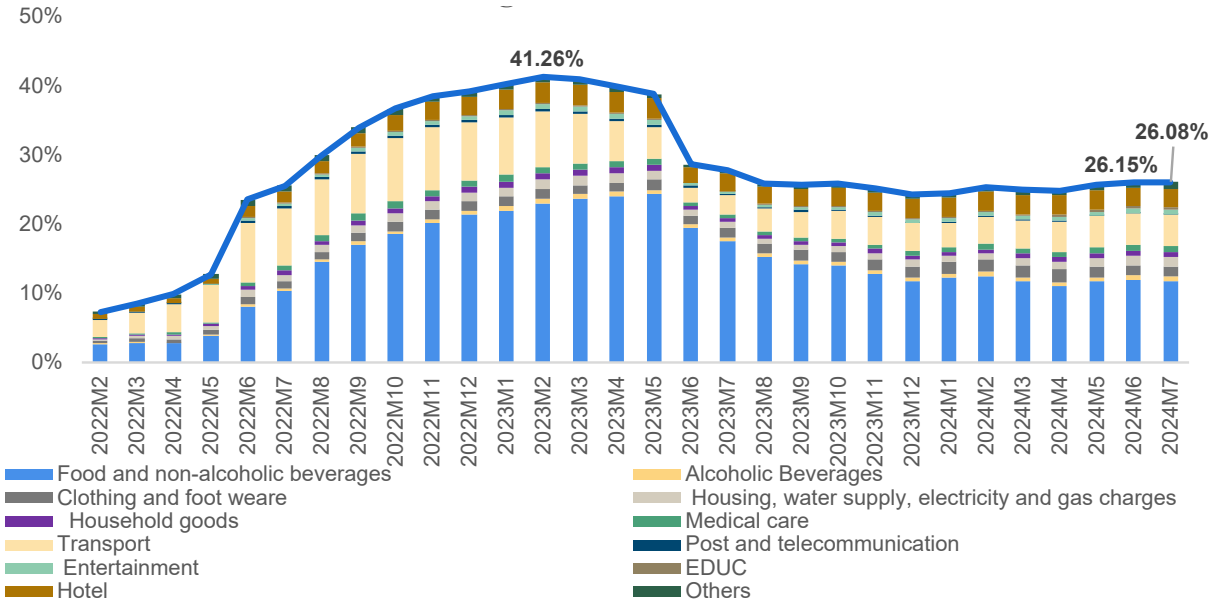
Three main categories in the basket of CPI, i.e., Food and non-alcoholic beverages, Transport and Hotels/Restaurant, comprise over 70% of the total item coverage in the basket. Therefore, it is generally perceived that prices of the three sectors will contribute most to inflation of Lao PDR as shown in the bar chart below. Despite the fact that Food and non-alcoholic beverages make up the most weights in the CPI basket (46.09%) - almost three times higher than the weight in the Transport category - the second highest weight (15.66%), Transportation prices contribute most to inflation from January to June 2022, followed by Food and non-alcoholic beverages. However, a switch occurred from July 2022 onwards where Food and non-alcoholic beverages took over as the primary inflation driver with Transport relegated to the second-highest contributor to overall inflation. Some of the underlying factors that drove the overall inflation level across different categories in the CPI during 2022/2023 include the surge in global and food prices, the depreciation of local currency exchange rates and the persistency of inflation expressed in the form of inflation expectation.

In terms of core CPI and non-core CPI, from July 2022 to November 2023, non-core CPI grew significantly, contributing mainly to the overall inflation compared to the core CPI component, mostly due to the surge in global commodity prices such as oil prices. However, from November 2023 until the present, a switch is happening as core CPI is rising more than the non-core CPI. Core CPI has stayed elevated while non-core CPI is already declining, which may suggest that the persistently high level of headline CPI since mid-2022 may have fed into the core CPI component.

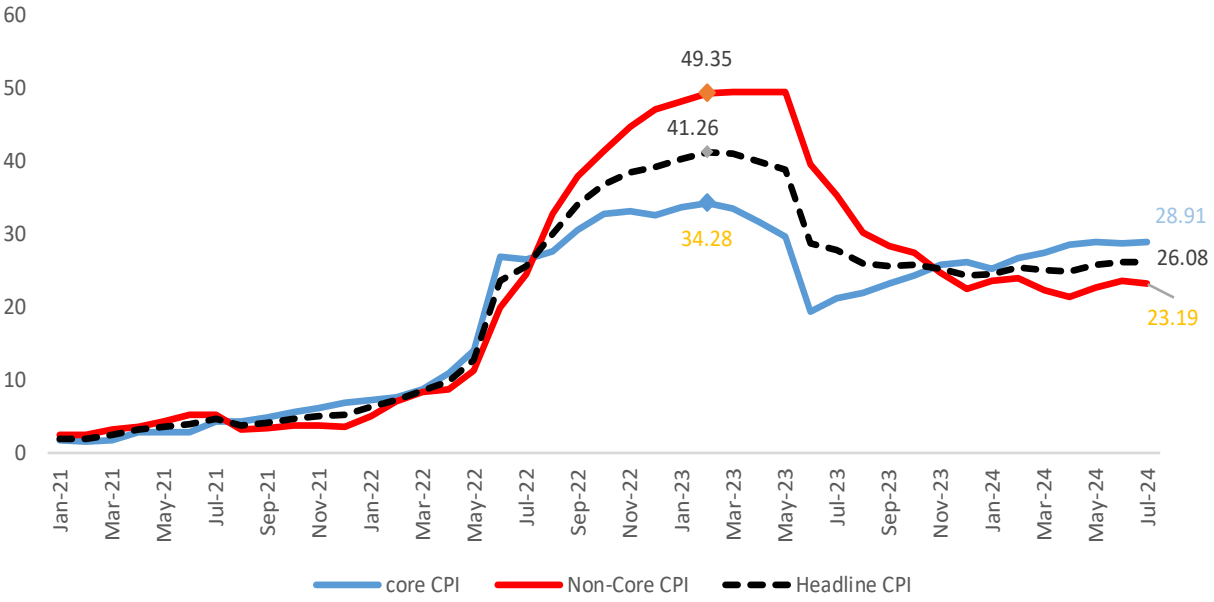
Inflation (YOY) vs Inflation (MOM)



Shares of 12 Sub-categories in the CPI Inflation of Laos



Year-on-Year Percent Change of Core and Non-core CPI



5. Recent Monetary Policy Responses

The monetary authority responsible for the implementation of monetary policies in Lao PDR is the Bank of the Lao PDR (BOL), which is the central bank of the nation. According to the Law of Bank of the Lao PDR, its three key mandates are to "secure monetary stability, sustainability of financial institutions and efficiency of payment systems, facilitating the integration to regional and international, contributing to national socio-economic development" (p.3, Bank of the Lao PDR, 2018). With regards to the definition of monetary stability, BOL focuses on maintaining both price and exchange rate

stability by relying on direct and indirect instruments including policy rate (namely "BOL Interest Rate"), daily official reference rate, reserve requirement ratio and open market operations. BOL's operating target is reserve money whereas intermediate targets are the annual rate of growth of monetary aggregates and the exchange rate. The inflation targets are set annually corresponding to the five-year national socio-economic plans.

Over the past years in the post-pandemic period (from mid-2022), Lao PDR has been confronted with numerous economic and financial challenges from both internal and external sources, particularly the volatility of exchange rate, oil price and gold price in the global market, resulting in the escalation of inflation in many countries around the world. In response to the high inflation, many central banks including the Federal Reserve (FED)[6] have implemented a series of tightening monetary policy. The interest rate hikes impacted the global financial market, resulting in the appreciation of strong currencies especially the USD, which has affected the volatility and depreciation of Lao KIP.

To maintain national monetary stability (price and exchange rate stability), BOL conducted a series of tight monetary policy responses through various instruments to reduce the fluctuation of exchange rates and inflationary pressure. These included the hike in the BOL rates (policy rate) from 6.5% per annum (p.a.) in 2022 to the current level of 10% p.a. in June 2024, the increase in the reserve requirement rates several times from 5% in 2022 to the current level of 8% for local currency and from 5% to 10% for FX currencies while also decreasing the eligible bonds that commercial banks can keep in the reserve requirement from 90% in 2018 to 70% in 2023 to 50%[7] in June 2024 for Lao KIP currency. Meanwhile commercial banks can only maintain reserve balance holdings at BOL for foreign currency in the reserve requirement (BOL, 2024). Recent developments also included issuing BOL bills to the public (6-month bills) several times over the recent years, and to the commercial banks, it issued 1-month, 3-month and 6-month bills as well as 3-month and 6-month deposits at BOL. More short-term, new instruments were also introduced for open market operations, including 7-day deposits, which were later replaced by 7-day bills. The purpose was to absorb excess liquidity from the banking system and actively manage short-term market interest rates and ultimately ease inflationary pressure. With regard to the exchange rate policies, BOL has made adjustments to the trading band in order for the exchange rate to be more flexible and narrow the gap between commercial banks and parallel market rates. A new department, the Foreign Exchange Management Department, was set up specifically in 2023 for foreign exchange management and effectively implement measures to control the flow of supply and demand of foreign exchange in the economy in order to maintain exchange rate stability.

6. The Federal Reserve (FED) raised interest rate 4 times in 2023 from 4.25-4.5% at the end of 2022 to 5.25%-5.5% in July 2023 (the highest level in 22 years).

7. Source: Bank of the Lao PDR.

6. Limitations and Plans for Development of CPI Compilation and Computation

6.1 Limitations

There are several challenges and drawbacks to the current CPI compilation and computation, which may lead to inaccurate inflation measurements that do not truly reflect the reality of current price changes. The current CPI still relies on weights derived from the fifth LECS conducted over ten years ago (2012/2013), and the basket of goods and services with the corresponding weights in the survey may be out-of-date, thus not accurately representing the current consumption patterns of the population. There is still limitation to some other price information such as the export price index, wholesale and retail price index and producer prices index, which are not readily accessible and may therefore restrict the comprehensiveness of the CPI calculation and the understanding of price changes in Laos. Moreover, the technical notes and methodology used to compile the CPI are not publicly available, which could hinder transparency and independent evaluation of its accuracy.

As such, without the availability of detailed information on methodology and compilation techniques, it is difficult to investigate the issues of mis-measurement in the treatment of specific goods and inflation such as the treatment of rentals and seasonal food items, substitution biases and quality changes.

The analysis of this country case study of Laos is limited to publicly available information and informal discussions with the staff from the relevant agencies. Some information used in this paper may be out of date and may not accurately reflect the current practices of price data collection and compilation of the CPI inflation. Further verification of these practices is needed from the relevant agencies. Additionally, budget availability to gather the necessary information and data for this paper has also been an obstacle. Securing funding for administrative and travel expenses could greatly enhance the analysis, ultimately leading to a more comprehensive study.

6.2 Plans for Development

There are some plans being put forward to improve CPI compilation and computation by the LSB. These include updating the base year and CPI basket based on LECS VI and LEC VII; using more advanced technological devices for collecting the data and a more integrated system of compilation and data analysis in the form of Web Scraping; improving the manuals concerning the specification of items collected and the process of collecting the price data; researching into the possibility of the higher frequency of base year updating (i.e., narrowing from every 5 years to 2 years) in order to reflect the consumer behaviour.

7. Conclusion

Inflation in Laos as measured by the Consumer Price Index (CPI) is the main price indicator in Laos. In the component of the CPI basket, food and non-alcoholic beverages hold the most weight and has become the main driver especially to the recent high level of inflation over the past few years in the post-pandemic era. Laos inflation has been a persistent challenge since mid-2022 due to internal and external factors particularly with the disruptive global supply chains and geo-political conflicts that drove up food and fuel prices and the exchange rate volatility in the global market. The internal factors include the depreciation of the Lao KIP, which stems from the persistent structural economic weaknesses as Laos heavily relies on importing goods from its neighbouring countries, mainly Thailand, China and Vietnam. As a result, the exchange rate has been put under pressure that has passed through to inflation, particularly in the food and non-alcoholic beverages sub-categories of the CPI. Therefore, the exchange rate is one of the important drivers of inflation. In the same way, Laos is still sensitive to the movement of the price level in the foreign countries especially Thailand, the key importer for Laos. The global commodity prices such as oil prices also impact the domestic price level as Laos fully imports oil from overseas. Another key contributor to inflation is the persistence of lagged inflation, which could reflect inflation expectations and how the society perceives the future level of inflation based on the past inflation period. With these factors in consideration, the Bank of the Lao PDR conducts an integrated approach between monetary policy and exchange rate policy to achieve price stability.

Price data collection and compilation of the CPI inflation in Laos still requires significant improvement especially on the update of a more relevant base year as well as the revision of the consumer baskets to be more up-to-date to reflect the current behaviour patterns of the people, especially in the post-pandemic era. Moreover, the dissemination and publication of information and data can also be strengthened particularly on the provision of more detailed CPI sub-components and regional CPI and the manual and guidelines on how price data is collected and calculated. These improvements are underway and the relevant agency has been working on these areas.

Understanding the data collection and compilation process, as well as the measurement of the CPI index, is crucial for policymakers, particularly those at the central bank, who are tasked with controlling inflation. Awareness of common issues in inflation measurement and strategies for improvement is essential to ensure that the CPI reflects economic realities. The mis-measurement and biases of the CPI calculation and collection process can result in misguided policy decisions, potentially undermining effective inflation control.

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CHAPTER 6

INFLATION IN MALAYSIA: MEASUREMENT, DYNAMICS, AND IMPLICATIONS FOR MONETARY POLICY

By
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1. Inflation Measurement

1.1 Introduction

This country-case report is a documentation of Consumer Price Index (CPI) compilation and computation, comprising several key measurement challenges pertinent to the construction of the index. The present case is part of a broader series of investigations commissioned by The SEACEN Centre to understand the "nuts and bolts" of CPI compilations in each participating country and their implications on monetary policy, as represented by several central banks in the region, namely Brunei Darussalam Central Bank, Bank of Korea, Reserve Bank of India, Bank of the Lao P.D.R., Bank Negara Malaysia, Bank of Mongolia, Nepal Rastra Bank, and Central Bank of Sri Lanka. The study will complement the integrative report conducted by the Centre for cross-country comparisons.

This report by Bank Negara Malaysia (BNM), delves into CPI-related information mainly utilising published reports by the compiler, The Department of Statistics of Malaysia (DOSM), ranging from Consumer Price Index publications, Household Expenditure and Income Surveys, Price Catcher[2] data, technical notes appended in the papers, and related research to the topic.

Section 1 of the report focuses on the construction of CPI, its gaps, and other derivations. These include coverage of the index, weight calculation, and indexation methodologies. Following the findings, insights on the limitations of the constructed CPI are gathered. Other derivations of the index are based on the indicators developed by the Bank, in pursuit of more robust inflation measures. Following that, Section 2 focuses on the additional inflation measurements and their implications for monetary policy.

The views expressed herein are solely those of the authors and do not necessarily reflect the views of BNM.

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2. Price Catcher data is daily price data of frequently purchased goods comprised of approximately 400 items collected across 1,000 premises. Prices collected are mainly for fresh food, packaged food products, dry food items, milk and baby products. Source: Ministry of Domestic Trade & Consumer Affairs.

1.2 Consumer Price Index (CPI) Compilation

1.2.1 History of CPI Compilation

According to the Department of Statistics of Malaysia (DOSM), the CPI was compiled for the first time using 1967 as the base year (1967=100). Subsequently, it has been rebased to 1980, 1990, 1994, 2000, 2005, and currently the year 2010 is used as the index reference period. In tandem, the CPI weight has been identified to be rebased since 2000 and recalculated in 2005, 2010, and 2016 as the weight reference period which was first expressed in the CPI in the December 2017 publication. This means that CPI data from 2018 until 2023 uses 2018 as the weight base period (i.e., 2018=100). Starting from the January 2024 release, the weight of the CPI basket of goods and services has been updated based on the Household Expenditure Survey (HES) conducted over twelve months from January to December 2022.

Objectively, inflation is used to measure the rate of change in the cost of purchasing a constant 'basket' of goods and services by households in a specified period, serving both domestic and international purposes as an inflation measure for the country.

1.2.2 Population Coverage and Sampling

With the release of the January 2006 CPI, the regional index was computed based on the urban and rural regional indices using the respective regional composite weights. The regional composite index was initially constructed based on four main zones namely, Northern, Eastern, Middle, and Southern zones (CPI 2010-2016) before more granular data of individual states in Peninsular Malaysia was gathered, with exceptions of a few combined indices including Perlis-Kedah; Wilayah Persekutuan Putrajaya-Selangor, and Wilayah Persekutuan Labuan-Sabah (CPI 2016-2022) due to smaller relative contribution for these states at that time. Currently, the composite price index that is aggregated to form the national price index is based on all 14 individual state indices in Peninsular Malaysia, Sabah, and Sarawak. The greater granularity over the years owes to the issuance of the nationwide census 2020 that shapes the sampling of the population covered in the CPI (Table A, Appendix).

Since its last update in 2010, the latest census is more representative of the overall population. The optimum sample size was estimated concerning selected household variables including ethnic group, age, occupation, and location of residency of the head household.

Following the issue of where the location of prices should be collected, it is important to acknowledge that the real-time expenditure of all households is necessarily not equal to total retail sales in outlets in the region partially due to online or overseas purchases. Hence, primacy is given to real consumption by households to define the weights in expenditure baskets reflective of locations they reside in, with the assumption that the purchases are made within the proximity. Here, the location and expenditure patterns of households become the dimensions of classification which helps the national statisticians to sample the locations of outlets (Table B, Appendix).

1.2.3 Weight Calculation

Once the reference population and the coverage of goods and services (based on expenditure patterns) have been decided, the weights need to be derived. In principle, the weights are calculated as proportions of the total consumption expenditure of all goods and services as the CPI basket is meant to be a reliable proxy of the average consumption among the reference population during a specific reference period.

Since 2005, the information on household expenditure is updated every 2-3 years. This means that the computation of consumption weights in the CPI basket is only feasible with a lag, as the new weights issued in the household expenditure surveys lags from the new price reference period for the price index (i.e., period when the new weights are introduced).

In terms of calculation, the approach to the weight computation for the CPI compilation uses the plutocratic method, whereby each household budget share is weighted by household expenditures by category, as a share of aggregate expenditures.

Table 1. A Stylised Example of HES 2016 Weight Calculation Using the Plutocratic Weights

Category	Household A (value)	Household B (value)	Household C (value)	Average value	Avg. value/ Avg. total expenditure (%)
01	743	608	827	726	18.0
02	79	98	117	98	2.4
03	134	150	124	136	3.4
04	1477	866	564	969	24.0
05	141	233	130	168	4.2
06	74	65	86	75	1.9
07	901	494	264	553	13.7
08	225	211	173	203	5.0
09	211	209	180	200	5.0
10	54	62	46	54	1.3
11	586	507	527	540	13.4
12	268	372	296	312	7.7
Total	**4893**	**3875**	**3334**	**4033**	**100.0**

Table 2. Aggregation Structure of Consumer Price Index (CPI) Based on Typical Guidelines by ILO

	Groups	Class	Sub-class	Elementary Aggregate		Representative product	Sampled product
Overall CPI	Food and non-alcoholic beverages	Food at home	Rice	W.P KL	Retail stores	Local Rice-5% Broken	• Rice Brand A (5% Broken) • Rice Brand B (5% Broken) • Rice Brand C (5% Broken) • Rice Brand D (5% Broken) • Rice Brand E (5% Broken) • Rice Brand F (5% Broken)
					Supermarket		
					Hypermarket		
					Fresh market		
					Mini market		
				Selangor			
				W.P Putrajaya			
				Penang			
				Johore			
				Perak			
				Kedah			
				Perlis			
				Terengganu			
				Kelantan			
				Pahang			
				W.P Labuan			
				Sabah			
				Sarawak			
			Eggs				
			Fresh meat				
			Fresh seafood				
			Others				
		Food away from home					
		Non-alcoholic beverages					
	Other groups						

Note: No. of outlets for price collection as of 2023 is 17,000 for Peninsular Malaysia, 2,400 for Sabah and 2,300 for Sarawak.
Sources: Price Catcher and Consumer Price Index publications by DOSM.

1.2.4 Seasonally Adjusted CPI

Malaysia is a country that is blessed with a multi-racial population consisting of three main races; Malay, Chinese and Indian. Major festivals in Malaysia celebrate different cultures and religions and they do not occur at a fixed date according to the Gregorian calendar. Specifically, major events including Eidul-Fitr for Muslims, is based on the Islamic calendar, the Chinese New Year follows the Chinese lunar calendar, and Deepavali adheres to the Hindu lunar calendar. Conventionally, the implication to prices following these activities should be considered due to their complex seasonality effects.

Distinctive trends between non-seasonally adjusted CPI and seasonally adjusted CPI can be seen in selected sub-sectors including food and non-alcoholic beverages, housing and utilities, as well as education (Chart 1). The selection of these categories is due in part to the higher weights of food and housing in the CPI basket being able to reflect higher domestic activities concerning festivities, and effective school holidays. Following these, prices on educational goods and services are also seasonally affected.

To compute, DOSM adopts the Seasonal Adjustment for Malaysia (SEAM), which helps remove price fluctuations driven by the seasonality effects, to get the seasonally adjusted data. Using the X-12 ARIMA program and a regression method, SEAM effectively removes the moving holiday effects from the CPI time series, allowing for a more accurate interpretation of trend estimates.

SEAM is a procedure primarily based on the use of irregular values obtained after performing an initial seasonal adjustment on the assumption that the moving holiday effects reside in the irregular series. The method involves two stages; (1) The first phase of the SEAM procedure requires the X-12 ARIMA program. Then, (2) a regression method with three regressors (REG1, REG2, REG3) is applied to remove moving holiday effects. REG1 uses one weight variable, REG2 uses two, and REG3 uses three. The weight variables capture the impact of holidays on economic activity.

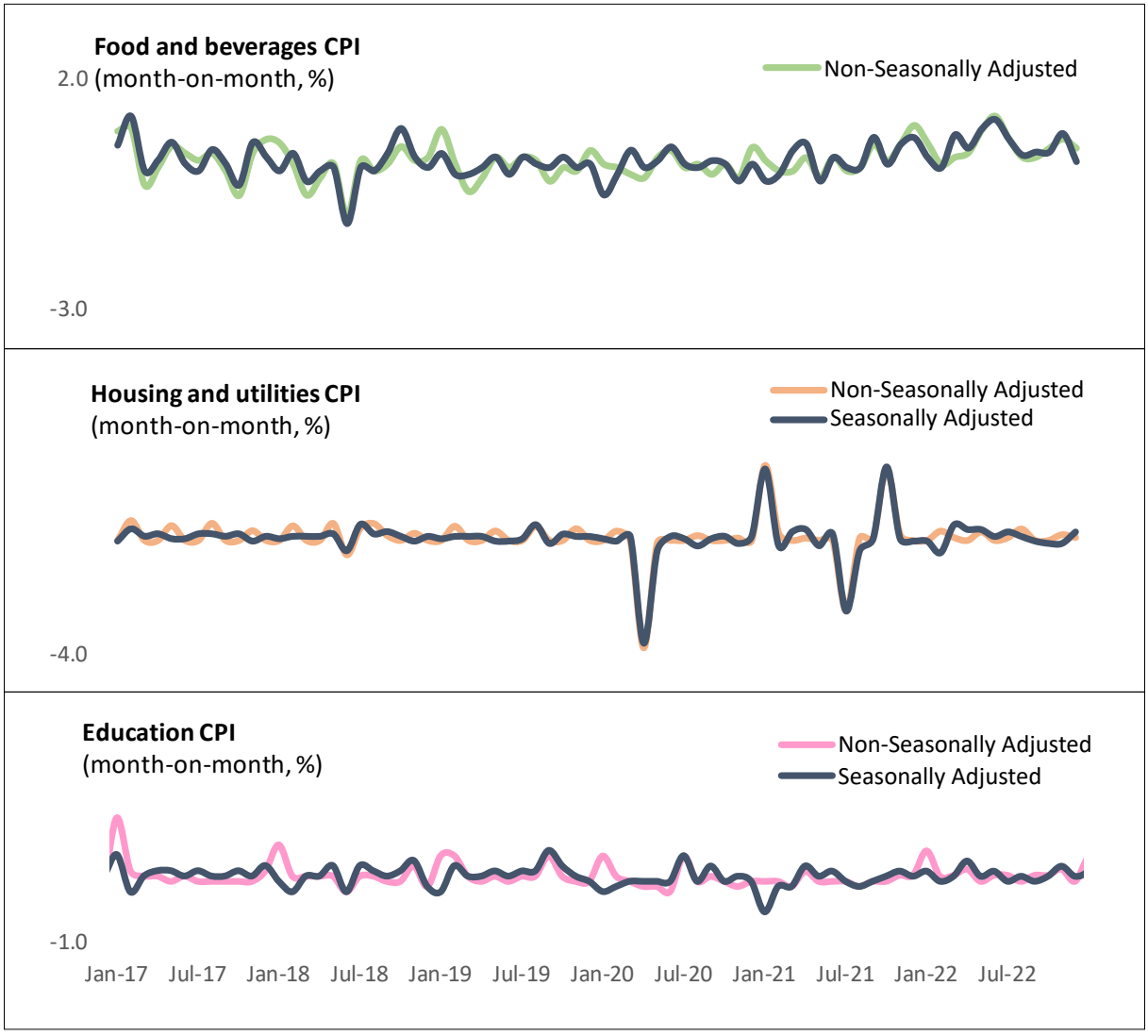
Table 3. SEAM Window Lengths

	No. of days		
	Before	During and after	Total
Eidul-Fitr	2	5	7
Chinese New Year	2	6	8
Deepavali	1	3	4

Table 4. SEAM Regressors

Regressor	Weight variable	
REG 1	One	Combination of Eidul-Fitr, Chinese New Year and Deepavali effects using SEAM window lengths
REG 2	Two	Combination of Eidul-Fitr, Chinese New Year and Deepavali effects using SEAM window lengths of before, during, and after events.
REG 3	Three	The Eid-ul Fitr, Chinese New Year and Deepavali festivals are separated into three different weight variables

Chart 1. Non-seasonally Adjusted and Seasonally Adjusted CPI for Food, Housing, and Education Category



Source: Department of Statistics Malaysia.

1.3 Price Index Calculation

Since 2016, the Department of Statistics has adopted the Laspeyres formula method in the CPI aggregation. The Laspeyres formula uses granular indices that are aggregated using weights, and subsequently followed by calculating the year-on-year change of the aggregated index to get the inflation rate.

Table 5. Laspeyres Formula for CPI Aggregation

$$\textit{Index for a CPI category} = \frac{(\textit{weight}_1 \times \textit{index}_1 + \textit{weight}_2 \times \textit{index}_2 + \ldots + \textit{weight}_n \times \textit{index}_n)}{\textit{sum of weights}}$$

$$\text{Transport index} = \frac{(0.2 \times 103) + (0.1 \times 105) + (0.1 \times 101)}{0.4} = 103.0$$

$$\text{Food index} = \frac{(0.3 \times 104) + (0.3 \times 105)}{0.6} = 104.5$$

$$\text{CPI} = \frac{(0.4 \times 103) + (0.6 \times 104.5)}{1.0} = 103.9$$

Table 6. A Stylised Example of March 2021 CPI Using the Laspeyres Formula

Granular level (4d)			Higher level (2d)			Overall (1d)
Consumer items	**Weight**	**Index**	**Categories**	**Weight**	**Index (formula)**	**CPI (formula)**
RON95	0.2	103	Transport	0.4	**103.0** *(A weighted average of RON95, RON97 and car service)*	**103.9** *(A weighted average of transport and food)*
RON97	0.1	105				
Car service	0.1	101				
Chicken	0.3	104	Food	0.6	**104.5** *(A weighted average of chicken and vegetables)*	
Vegetables	0.3	105				
Total	1.0					

Inflation for March 2021		
CPI March 2021	**CPI March 2020**	**y-o-y Change**
103.9	102.2	1.7%

The method ensures consistency of weight computation when they are revised during the year.[3]

***First step**: Under the old weight, the CPI is calculated as usual using the Laspeyres formula (Period 0 = 100).*

	Transport	**Food**	**CPI (Weighted average - Laspeyres)**
Old Weight	*0.4*	*0.6*	*1.0*
Indices			
Period 0	100	100	100
Period 1	103	104.5	103.9
Period 2	104	105	104.9

***Second step**: With the new weight and the new base period, a new CPI series is calculated using the usual Laspeyres formula, starting from Period 2 (Period 2 = 100).*

	Transport	**Food**	**CPI (Weighted average - Laspeyres)**
Revised Weight	*0.5*	*0.5*	*1.0*
Indices			
Period 2	100	100	100
Period 3	101	102	101.5
Period 4	103	103	103

***Third step**: To synthesise the old and new CPI series, "linking factors" need to be obtained. The linking factors serve to ensure consistency between the old and new series, and are derived based an overlapping period in these two series. In this case, the overlapping period refers to Period 2, since it appears in both old and new weights.*

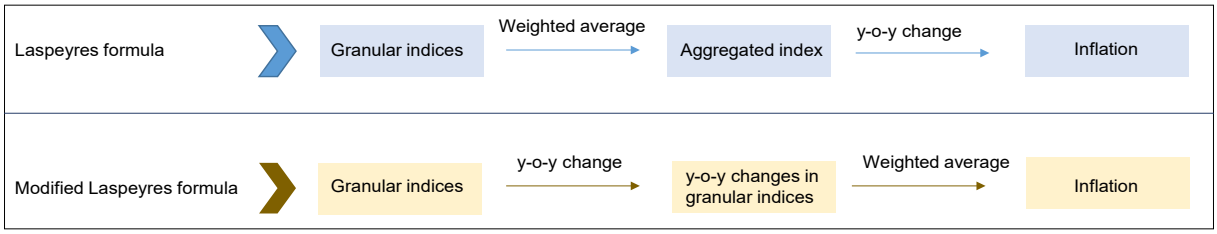
	Transport	**Food**	**CPI (Weighted average)**
Linking factors = Index in old series / Index in new series			
Period 2	104/100 = **1.04**	105/100 = **1.05**	104.9/100 = **1.049**

3. 2018 CPI weights were based on the survey results from HES 2016.

***Fourth step**: Synthesise the old and new CPI series by applying the "linking factors" to the new series. One can also instead apply the correct linking factors to the old series while retaining the new series.*

		Transport	Food	CPI (Weighted average)
	Indices			
Old series	Period 0	100	100	100
	Period 1	103	104.5	103.9
	Period 2	104	105	104.9
New series (adjusted by **linking factors**)	Period 3	101***1.04** =105	102***1.05** =107.1	101.5***1.049** =106.5
	Period 4	103***1.04** =107.1	103***1.05** =108.2	103***1.049** =108

After the revision is calculated, the adjusted series is no longer able to be imputed using the simple Laspeyres formula.



BNM uses a similar method with a different technique, where the sequence of calculation is reversed from the original formula. In contrast to the Laspeyres Formula, under the modified case, the process begins instead with calculating the year-on-year change of the granular indices. These changes are then aggregated using the weights to get the overall inflation. These differences are captured as follows:

The appeal of the modified Laspeyres formula is the ability to maintain consistency in aggregation to headline inflation between DOSM's compiling practice and BNM's surveillance practice. As an example, the modified approach has been able to match the official inflation in 2016.

Table 7. Computation of Consumer Price Index using the Modified Laspeyres Method

Months	Actual Inflation Published by DOSM	Estimated Based on (non-modified) Laspeyres Formula	Estimates Based on the Modified Laspeyres Method Adopted by BNM
Jan-16	3.5	4.9	3.6
Feb-16	4.2	5.6	4.2
Mar-16	2.6	4.1	2.8
Apr-16	2.1	3.6	2.2
May-16	2.0	3.4	2.1
Jun-16	1.6	3.0	1.7
Jul-16	1.1	2.5	1.3
Aug-16	1.5	3.0	1.6
Sep-16	1.5	3.0	1.6
Oct-16	1.4	2.8	1.5
Nov-16	1.7	3.1	1.7
Dec-16	1.7	3.2	1.7

1.4 Reliability of CPI as a Measure of Inflation

1.4.1 Classification Standard and Data Frequency

The standard COICOP classification adopted to categorise the items in the CPI basket in Malaysia allows for cross-country comparisons of inflation measures. As the COICOP provides a framework for both goods and services of household consumption categories, Malaysian CPI data can be read alongside international CPI data which complies with the same classification standard.

CPI publications are released every month with a one-month lag time. For example, the November 2023 CPI publication was released only on 22nd of December in the same year. Given the one-month lag, the CPI measure is a lagging indicator as outturns for the current month could only be assessed preliminarily before they were validated in the following month.

1.4.2 Limitation of HES as a Source in the Computation of the CPI Weights

Information from HES for certain types of expenditures may not be sufficiently reliable due to some tendency to under-report some purchases that are deemed exceptional or products that come with social stigma such as purchase of lottery tickets. In the event that no adjustments are made for such under-reporting, underestimating the expenditure and consumption weights on certain items will cause the overestimation of weights for the correctly reported items (ILO, 2004). This issue may compromise the quality of expenditure data that is reflected in the CPI consumption, and may not be reflective of actual average consumption patterns.

In this case, a robustness check using other resources is highly encouraged by international standards, to identify certain types of expenditures which may not be covered in HES but are reported elsewhere. Another reliable resource in Malaysia other than CPI and HES is the "Belanjawanku" reports published by the Social Wellbeing Research Centre University of Malaya (SWRC-UM).[4] The Belanjawanku report compiles the expenditures for the country's urban population across selected cities. To provide comprehensive information, the compilation employs robust methods, including focus group discussions (FGDs) with local universities and government agencies as well as surveys.

Moving forward, results from the HES should be compared with statistics from other sources such as credit card spending data and online purchases, especially when the HES sample is small relative to the whole population.[5]

In addition, the reliability of the CPI weights will depend to a large extent on the quality of the household expenditure data. The infrequent adjustment to the CPI weights inherently reduces the relevance of the CPI data relative to the changing domestic consumption patterns for households, especially in the post-pandemic years. In comparison to HES 2016, which is still the effective weight of the latest 2023 CPI, HES 2022 shows that there is a noticeable increase in the consumption weight for the expenditure at restaurants and hotels, rising from 13.4% to 16.1%, owing to the increase in food away from home spending from 10.7% to 12.9% (Table 8).

Table 8. Household Expenditure Survey (HES) Comparisons on Restaurant and Hotels Expenditure Weights

Expenditure weights (%)	HES 2016	HES 2019	HES 2022
Restaurant and hotels	**13.4**	**13.7**	**6.1**
Food away from home	10.7	11.2	12.9
Beverages away from home	2.1	2.1	2.4
Accommodation services	0.6	0.6	0.8

Other items experiencing higher consumption weights since HES 2016 include furnishings, household equipment and routine household maintenance (2022: 4.7%, 2019: 4.2%), health (2022: 2.2%, 2019: 1.9%), and communication (2022: 6.6%, 2019: 5.0%).

Although the changes in weights in recent years are arguably due in part to the pandemic-related disruptions and bottleneck effects from the economy reopening, these transitions should be captured in the CPI compilation to allow for a more updated

4. Source: "Belanjawanku." Social Wellbeing Research Centre, SWRC. March 23, 2023. Available at: https://swrc.um.edu.my/introduction-belanjawanku

5. HES sampled 90,000 households to represent 32 million population, in which the poorest and the richest segments are not included.

analysis on inflation especially on the impact of higher prices of salient items to domestic consumption. Due to the retention in CPI weights despite the latest issuance of HES, data on relative prices such as food away from home items are prone to understatement. The use of current weights may either understate the impact of sharp relative price movements for segments such as food away from home, or the underlying quantities are assumed to vary in response to changes in relative prices for which households are presumed to substitute for cheaper products to maintain purchasing patterns in the current year while acknowledging that input prices are higher in recent times.

According to the CPI manual, countries are advised to revise and update their expenditure weights each year (ILO, 2004). This is partly to avoid the prolonged use of fixed baskets of goods and services data within a period which causes biases in the compilation to accumulate, especially when the Laspeyres price index method is used.

1.4.3 Challenges in Capturing Complex Information

Although there has been an effort to improve the method in removing the seasonal effects on prices, it is worth noting that there are other festivals than those indicated in the model, which take place annually. These are namely, Eid-ul Adha, Independence Day (Merdeka), Christmas and New Year, Thaipusam, as well as native festivals such as Pesta Kaamatan (Rice Harvest Festive) and Pesta Gawai. These festivities, which are not captured in the SEAM model, induce greater domestic activity, posing additional complexity on the seasonality effects on prices.

Apart from that, it is also important to note that the price signals during festivities have never been fully reflective of domestic supply and demand during the seasons. In part, these prices have already been distorted by the prevailing controls and subsidies on key necessities, which are imposed during every major celebration, particularly affecting food items and transportation fees (see detailed example in Table C, Appendix). Of importance, the long period of implementation for these price schemes may overlap with the festival window lengths as indicated in the SEAM festival regressors which complicate overall price signals during celebrations (Table 9).

Table 9. The Difference in Festival Window Lengths in SEAM Regressor and During Season Price Ceiling Scheme

Festive	Festival Window Length for the Regressors in SEAM			Festive Season Price Ceiling Scheme *(Tentative)*		
	Before	During	After	Before	During	After
Eid-ul Fitr	2	5	7	15		
Chinese New Year	2	6	8	12		
Deepavali	1	3	4	10		
Christmas				5		

Moreover, with the discontinuation of Import CPI compilation in 2015, the prevailing CPI compilation at this juncture does not provide any inkling on the items with imported content (intermediate imported goods), except if the goods are directly bought from abroad (final imported goods). Although there have been alternative sources suggested by the ILO and IMF to quantify the import content in domestic consumption, a specific compilation of Import CPI or imported price index could benefit policymakers in assessing prices of items that are more sensitive to exchange rate movements. At this juncture, imported input can only be partially measured in the context of overall production using the Input-Output (IO) Table 2020, as it provides quantification of the production in industries concerning the uses of domestic and other imported products.

Based on the approximate mapping of the commodity classification to consumption by purpose from the IO 2020 data, the latest estimates by BNM on the total share of import content in domestic consumption is 26%, with a higher percentage of shares found in the food and beverages and transportation categories (Table 10).

Table 10. Import Content of Consumption According to CPI Class

	CPI category	Import content of consumption (%)
1	Food and beverages, tobacco, restaurants and hotels	7
2	Clothing and footwear	1
3	Housing and utilities	5
4	Furnishing, household equipment and maintenance	2
5	Health	1
6	Transport	5
7	Communication	1
8	Recreation services and culture	2
9	Miscellaneous goods and services	2
	Total	**26**

Note: The import content refers to imported intermediate inputs and final consumption goods.

Thirdly, all prices for goods and services collected to construct the CPI are assumed to be sold and purchased in physical stores. Given the higher prevalence of online spending in the post COVID-19 landscape, online platforms could offer a wide range of complementary datasets to validate prices that are collected in-store. The rationale for the exclusion of online prices in the CPI is due in part to high-frequency price adjustments following the fluctuations in demand algorithm, given lower search cost for households which induces higher competition among firms within online platforms.

In instances where changes in domestic policy on tax for online purchases are introduced, such as the 5% Low Value Goods Tax (LVGT) for lower-priced imported goods purchased online of below RM500 beginning January 2024, the impact on price levels is inevitable, although this may not be directly visible to inflation.

1.4.4 Prevailing Price Controls

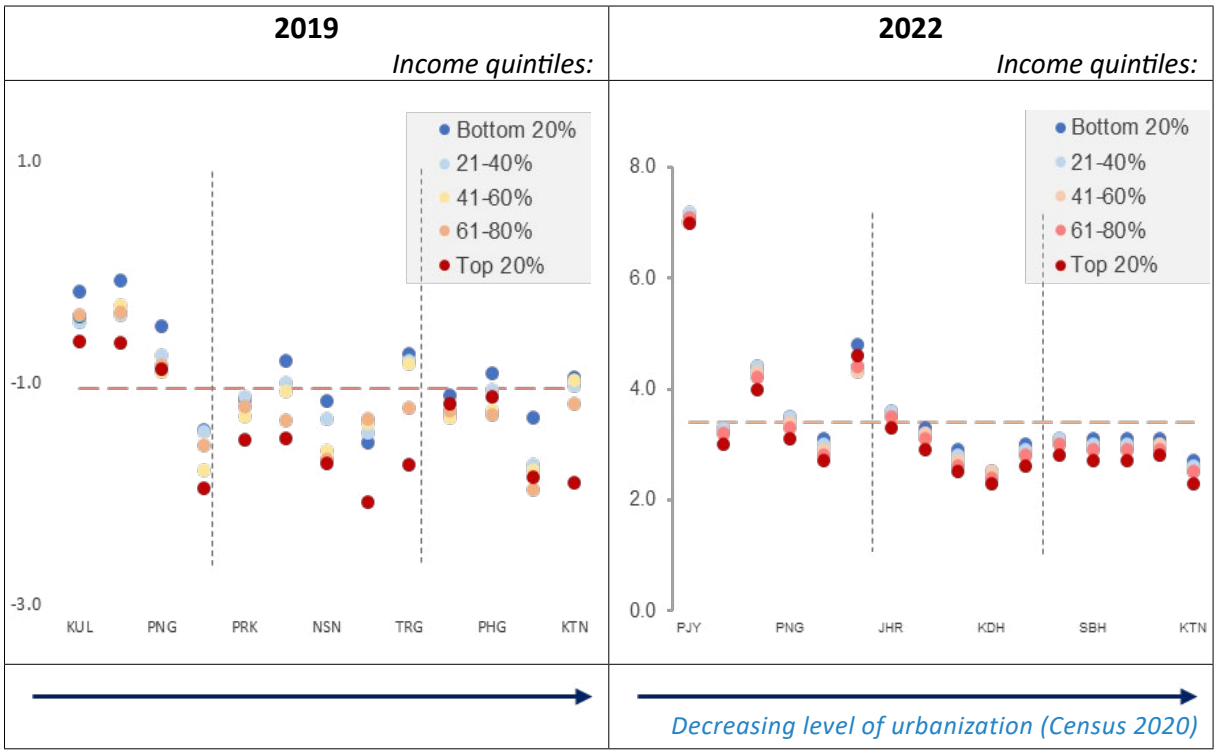
The prolonged price controls on frequently purchased items including staple food and retail fuels have distorted domestic price signals. Until now, price signals of many salient items such as staple food and fuel are muted, masking important information that is critical for policy makers concerning the supply and demand conditions in the local economy.

Aside from the extensive coverage, the changing stance on subsidy coverage exposes the compilation to classification errors especially when the grouping needs to be frequently updated following the policy changes. At this juncture, different treatments for varying controlled items reflect the challenge of isolating subsidised items in the CPI basket, given the most granular category also covers a variation of items that are not price-administered (Table D, Appendix).

1.4.5 The Unequal Distributive Impact of Inflation

The unequal impact of higher prices has caused divergence in the standard of living across households in different income groups. This has heightened the cost-of-living issue among domestic consumers, especially in a high inflation environment. An aggregated inflation value has been unable to reflect the living conditions of some segments which are more vulnerable to higher prices. In 2022, lower inflation was observed in less urban states and for higher-income groups, while the majority of lower-income households experienced higher inflation than their same-state neighbours (Chart 2). The narrative remains largely similar to that before the pandemic years.

Chart 2. CPI Inflation by States and Income Groups in 2019 and 2022



To a larger extent, the divergence in inflation rates across income groups is a common finding in many countries. Lower-income groups generally experience higher inflation than higher-income groups due to the larger share of food items in their consumption basket. In addition, the larger divergence in inflation rates is also due to greater income disparity among households. Between 2019 and 2022, lower-income earners residing in rural areas are most affected by the low growth in incomes, despite facing the highest expenditure growth (Table 11).

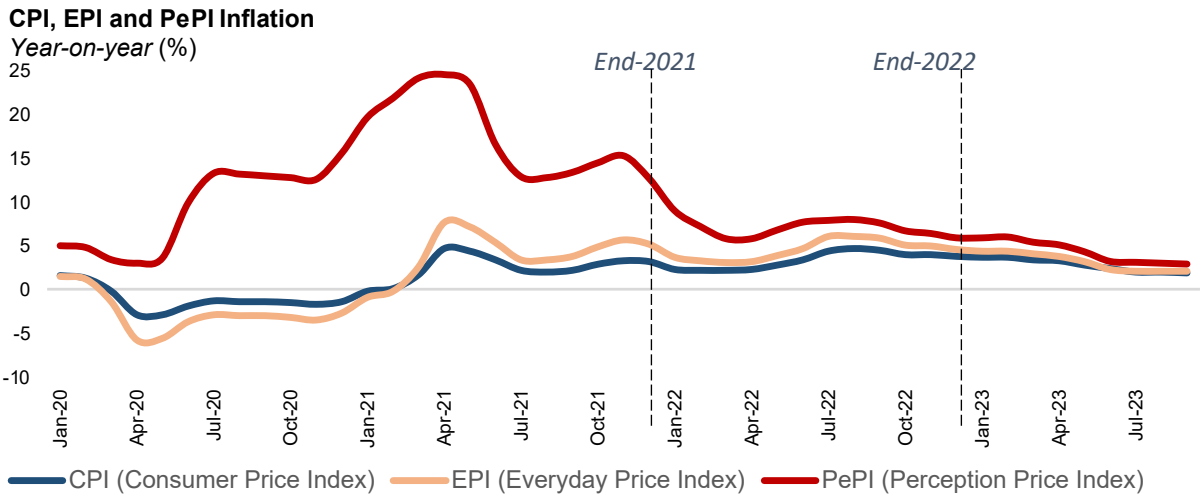
Table 11. Median Income and Expenditure Growth by Income Group, CAGR (%)

	Income threshold					
	Bottom 40% (B40)		**Middle 40% (M40)**		**Top 20% (T20)**	
2019-2022	Urban	Rural	Urban	Rural	Urban	Rural
	Households earning less than RM 6,030	*Households earning less than RM 3,510*	*Households earning between RM 6,030 -12,900*	*Households earning between RM 3,510 - 7,040*	*Households earning more than RM 12,900*	*Households earning more than RM 7,040*
Income (CAGR, %)	+12%	+3%	+11%	+5%	+7%	+2%
Expenditure (CAGR, %)	+15%	+15%	+13%	+11%	+9%	+12%

Source: Department of Statistics Malaysia.

The divergence in perceptions and the presence of perception bias on inflation are also due in part to heterogeneity in consumption patterns across different subgroups in Malaysia. The stabilising inflation level, when not perceived to translate into better living conditions and higher purchasing power, usually leads to the public's scepticism towards the CPI compilation and by extension, inflation itself. During a high inflation environment, there is an upward bias in consumers' inflation expectations as households are more affected by the price movements of items purchased frequently, as measured by the Everyday Price Index (EPI), and more inclined to remember price increases than price declines, as measured by the Perceived Price Index (PePI) (Chart 3, for details see Table D in Appendix).[6]

Chart 3. Different Inflation Perceptions in Malaysia.



Other countries like the United States use household panel data to study the differences in consumption baskets within categories in a more granular manner, to form consumption insights on consumer switching behaviours and substitution effects on prices during high inflation. This information is beyond what HES can offer.

Aside from that, although product switching is an integral part of shopping behaviour in response to increasing inflation, the Laspeyres index computed for the CPI data assumes that consumers maintain their original purchases on items with unchanging quality while embracing eroding purchasing power, due to the index being agnostic on substitution effects.

6. Source: Bank Negara Malaysia. Inflation: Perception vs. Reality. Kuala Lumpur: BNM 1Q 2017 Quarterly Bulletin, 2017.

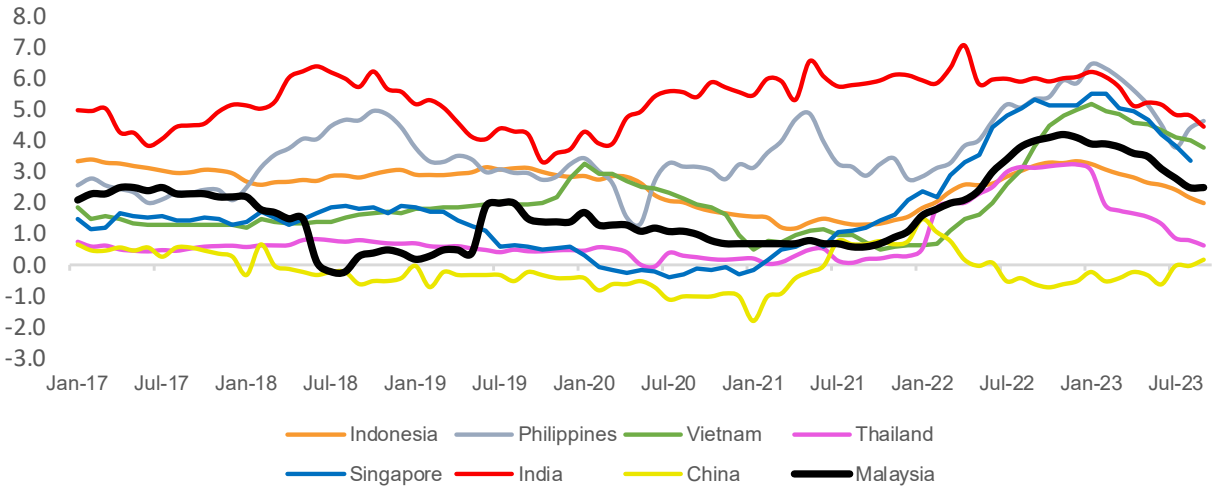
1.5 Other Derivation to CPI

1.5.1 Core Inflation

Many central banks use core CPI as a measure of underlying inflation. Many inflation-targeting economies consider the indicator as a better guide than other indices as it is removed from transitory influences and shocks-related price fluctuations.

Core inflation trend in Malaysia has historically been lower than the other countries in the Southeast Asia region. The differences in long-term trends may potentially be due to different methodological approaches in constructing the core index, as well as the country-specific factors on domestic consumption.

Chart 4. Core CPI by Countries
(year-on-year, %)



Many economies exclude volatile components such as fresh foods and fuel, as well as price-administered goods that are susceptible to changes in Government price controls. Permanent removal of food and energy prices is the most adopted method for core CPI in many central banks, while some countries in advanced economies exclude indirect taxes and mortgage loans.

Table 12. Computation of Core CPI in Regional Economies

Central Bank	Core CPI Construction	Components Excluded from / Included into Core Inflation	Excluded Weight (%)
Bank Negara Malaysia	Exclusion-based method	Fresh food Energy Rental Administered Prices	26.3
Bank of Indonesia		Price volatile Administered prices	~40.0
Bangko Sentral ng Pilipinas		Fresh food Energy *Rice, corn, fruits and vegetables, LPG, kerosene, oil, gasoline, and diesel.*	18.4
Bank of Thailand		Fresh food Energy *Rice, flour, cereal products, vegetables, fruits, electricity charges, cooking gas, and gasoline.*	23.0
Monetary Authority Singapore		Cost of personal transports Cost of accommodation	34.2
Reserve Bank of India		Non-food manufacturing inflation is constructed as the core indicator	55.0

Note: Weight reference based on CPI 2023.
Source: National authorities

In Malaysia, the core CPI is constructed using the exclusion-based method, which permanently excludes items displaying price fluctuations that are considered transitory in nature and do not have a lasting impact on the underlying inflation trend. Subsequently, the subcomponents of the overall consumer price index are reweighted with the weights implied for the core index.

Table 13. Computation of Core CPI in Malaysia

	Category	Headline Index (%)	*Non-core items (%)*	*CPI Weights Excluding Non-core Items (%)*	Core Index (%)
01	Food and non-alcoholic beverages	29.5	9.9	19.6	**26.5**
02	Alcoholic Beverages & Tobacco	2.4	2.4		
03	Clothing & Footwear	3.2		3.2	**4.5**
04	Housing, Water, Electricity, Gas & Other Fuels	23.8	4.2	19.6	**26.5**
05	Furnishings, Household Equipment & Routine Household Maintenance	4.1		4.1	**5.5**
06	Health	1.9		1.8	**2.6**
07	Transport	14.6	9.8	4.8	**6.5**
08	Communication	4.8		4.8	**6.5**
09	Recreation Services & Culture	4.8		4.8	**6.6**
10	Education	1.3		1.3	**1.8**
11	Restaurants & Hotels	2.9		2.9	**3.9**
12	Miscellaneous Goods & Services	6.7		6.7	**9.1**
	Total	100.0	26.3	73.7	**100.0**

Note: Based on 2018 weight.

The greater service weight assigned in the core index partly reflects that less tradable components are, by nature, driven to a greater extent by the domestic labour market and demand conditions and hence better correspond to the underlying price level.

Table 14. Goods and Services in Core CPI in Malaysia

Code	Headline Index	Core Index
Goods	49.2	23.8
Services	50.8	49.9
Total	100	73.7

Note: Based on 2018 weight.

2. Inflation Dynamics and Monetary Policy in Malaysia

2.1 Global vis-à-vis Malaysia's Inflation Dynamics

Malaysia's headline inflation largely remained on a moderate trend, averaging 2.2% between 2011 and 2019, except during episodes of shocks—primarily global crude oil and food price shocks and domestic policy changes on prices—which witnessed headline inflation going above its long-term average.

The COVID-19 pandemic in early 2020 until the endemic in late 2021 significantly impacted inflationary trends both globally and in Malaysia. The post-pandemic economic reopening caused inflation to shoot up to a higher level for longer amid the uneven recovery in the domestic economy. However, the above-average inflation trend in Malaysia took a relatively shorter time to revert to its pre-pandemic trend than those in advanced economies (AEs) and the regional emerging market economies (EMEs), demonstrating a modest post-pandemic trajectory.

Chart 5. Headline Inflation in Malaysia and Selected AEs
(year-on-year, %)

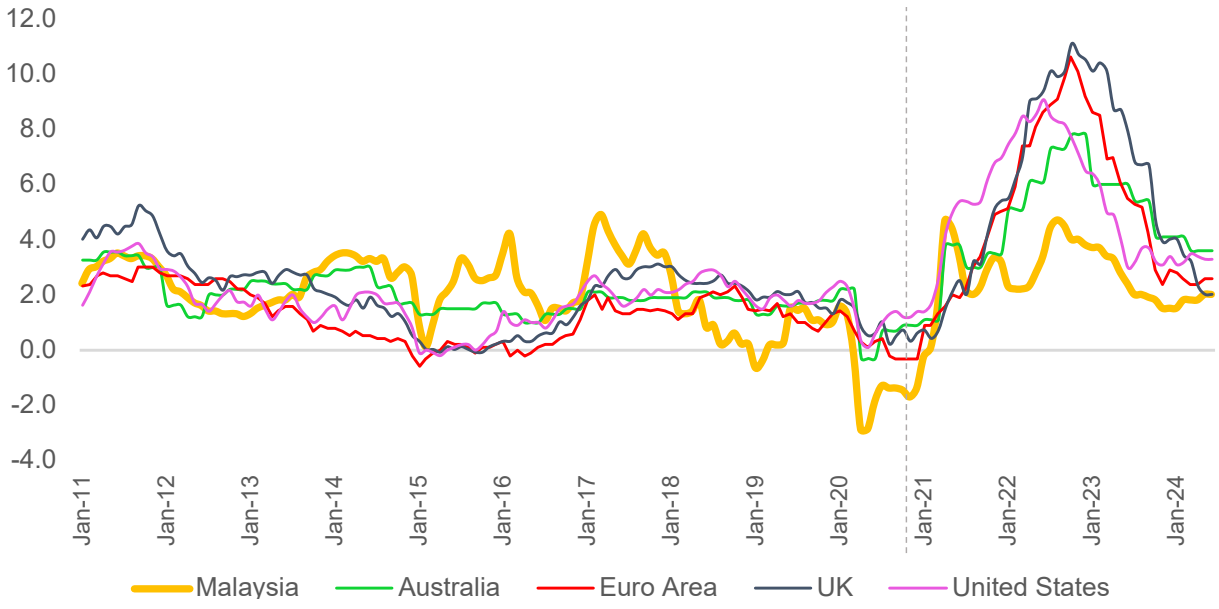
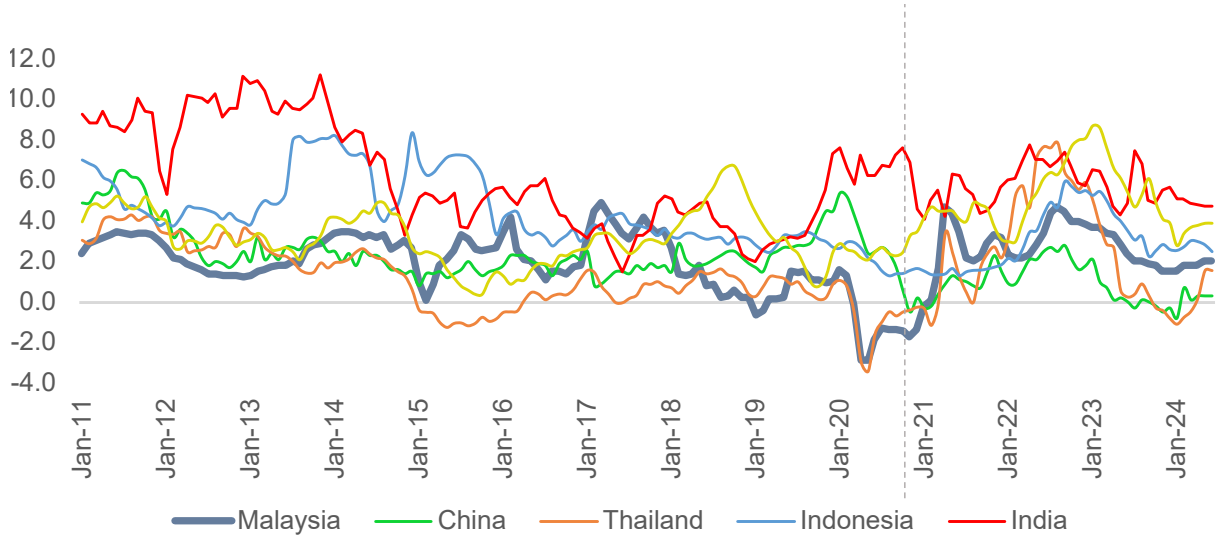


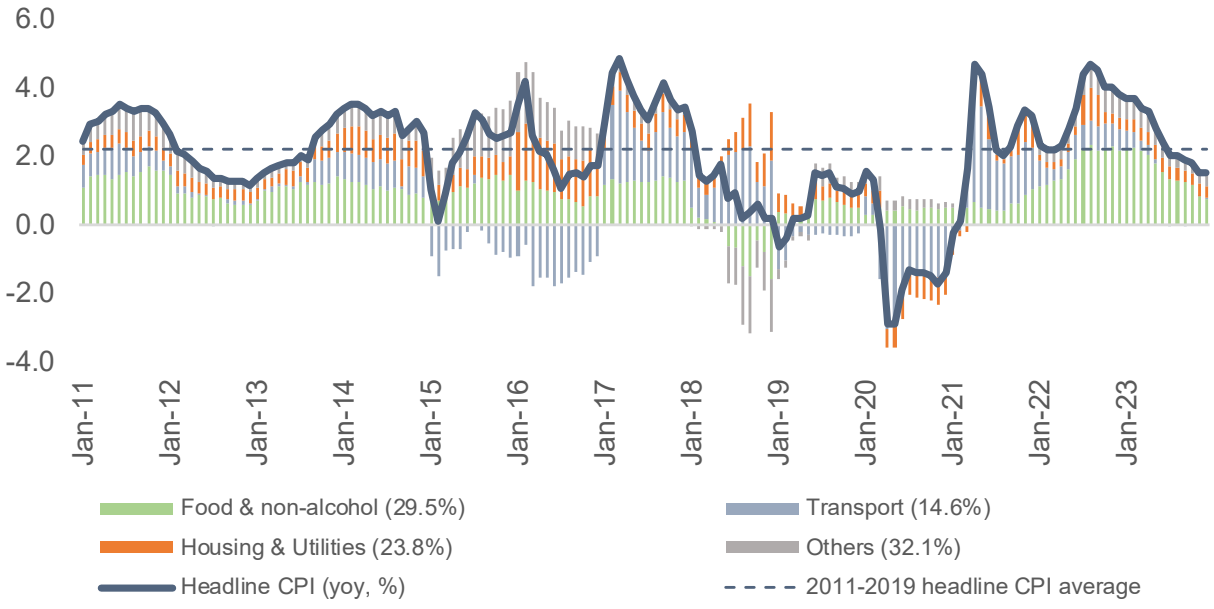
Chart 6. Headline Inflation in Malaysia and Selected EMEs in Southeast Asia
(year-on-year, %)



2.2 Drivers of CPI Inflation

In Malaysia, inflation is predominantly influenced by price changes for food, housing, and transport categories, given their substantial weight in the CPI (Chart 7). The prices of food and fuel are particularly sensitive to both global and domestic factors. These include global prices, supply-side dynamics, and domestic policy changes on key items, all of which play a critical role in shaping inflation trends.

Chart 7. Contribution to Headline Inflation
(percentage points, ppt)



Throughout the past decade, Malaysia has experienced several periods of high inflation relative to its historical trend, driven by various external and domestic factors. These episodes highlight the interplay between global market dynamics and local economic policies. Beyond supply-side factors, domestic consumption and activity propelling demand-driven inflation, also play a critical role in influencing the underlying inflation dynamics.

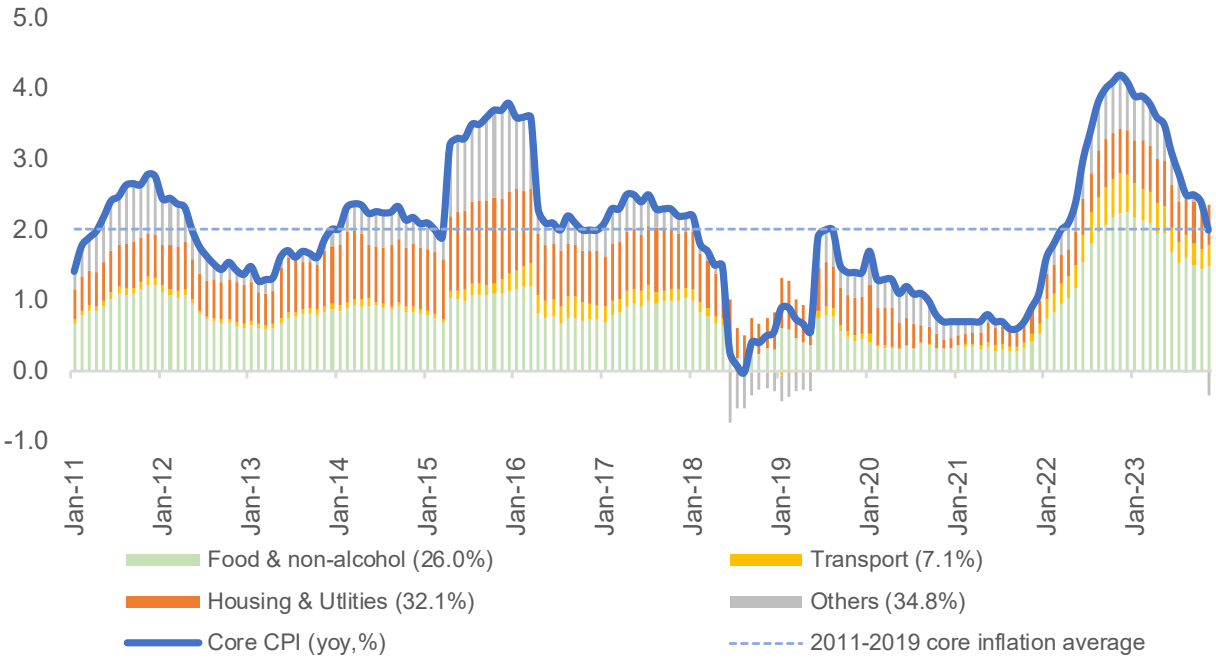
2.2.1 CPI Inflation During the COVID-19 Reopening

The period of 2022 to 2023 witnessed a significant surge in inflation as the country navigated the post-pandemic economic recovery. The rise of global commodity prices due to supply chain disruptions and the Russia-Ukraine conflict played a major role in this inflationary episode, leading to increased global fuel and food prices. These passed through into the domestic economy and resulted in a rise in inflationary pressures in Malaysia, which peaked at 4.5% in September 2022.

These external shocks, coupled with the stronger domestic demand conditions following pent-up demand from the reopening, gave rise to higher overall underlying inflation. Core inflation (excluding price-administered items and price-volatile) experienced significant increases, peaking at 4.2% in November 2022, mainly due to elevated food away from home inflation (Chart 8).

Chart 8. Contribution to Core Inflation

(percentage points, ppt)



2.3 Broad-based and Common Inflation Dynamics

In Malaysia, the extent of broad-based price increases is usually evident in the higher average share of CPI items that record monthly price increases. When inflation is driven by economy-wide or common factors, inflationary pressures can become more widespread (as measured by the number of items with price increases, see Chart 9) and persistent (as measured by the number of months with continuous price increases, see Chart 10).

Chart 9. Average Share of CPI Items Recording Month-on-month Price Increases
(percentage of CPI items, %)

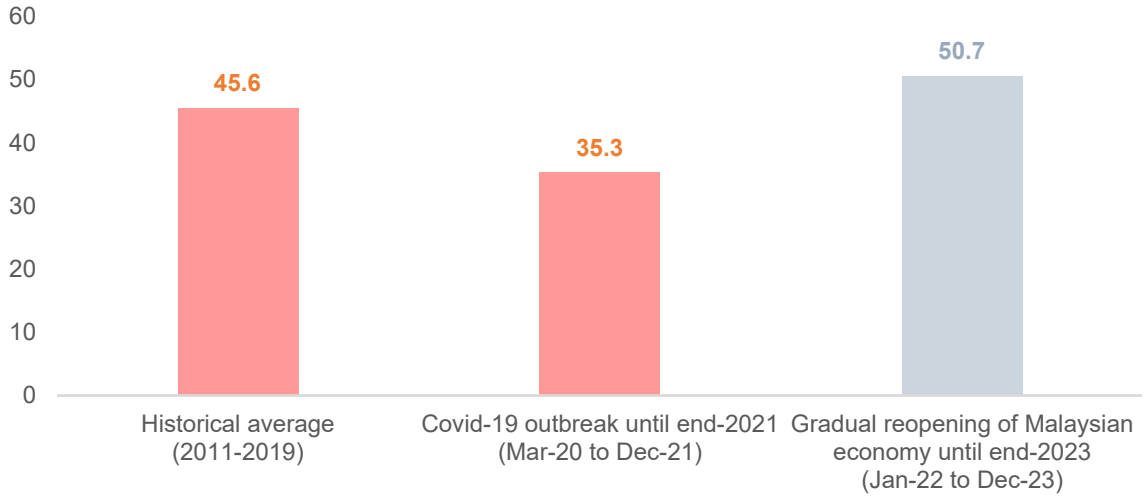
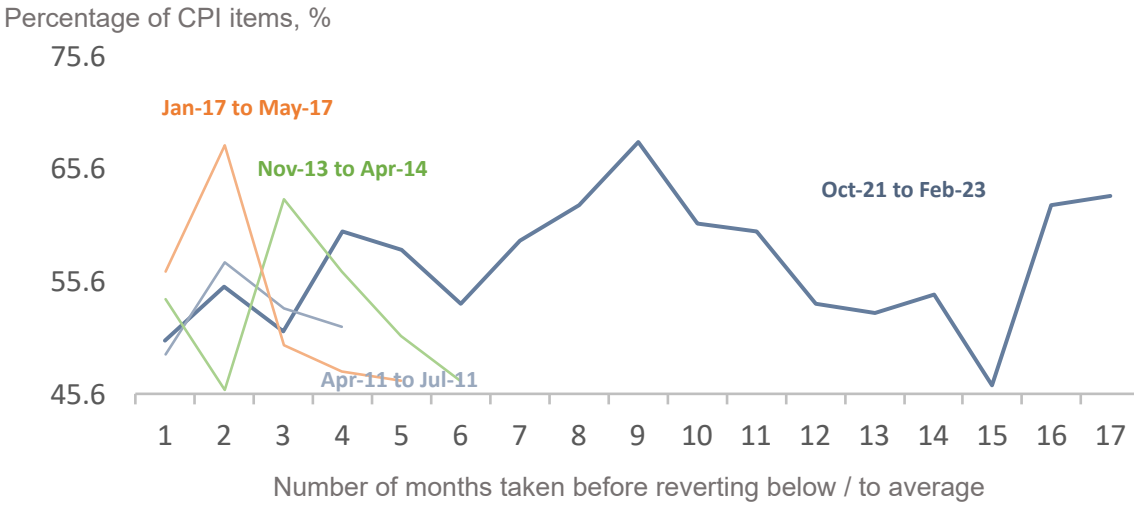


Chart 10. Episodes of Consecutive Above-average[1] Share of CPI Items Recording Month-on-month Price Increases[2]

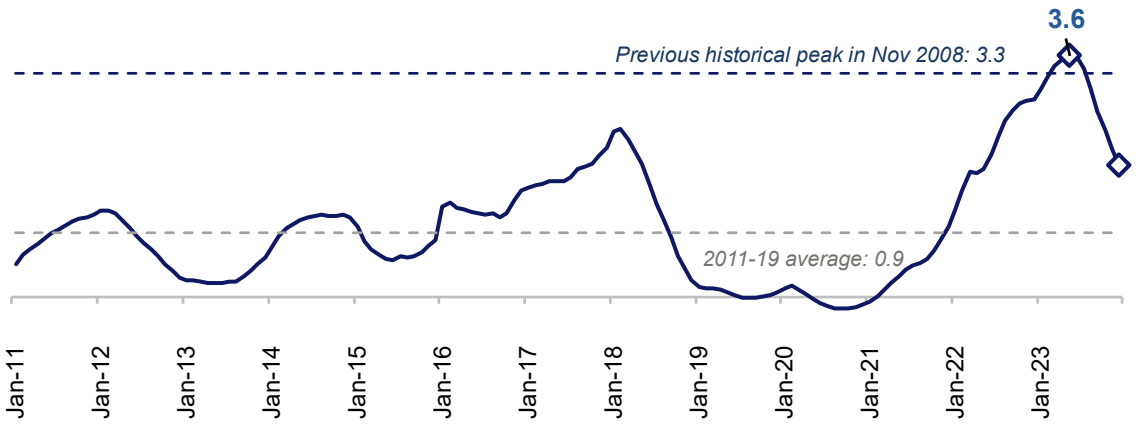


1/ The average share of CPI items recording month-on-month price increases is 45.6% of the CPI basket, which is calculated based on monthly frequency from January 2011 to December 2019.
2/ This is calculated based on the month-on-month inflation for 125 CPI items at the 4-digit level.

Source: Department of Statistics, Malaysia and Bank Negara Malaysia estimates.

Additionally, the common trends in price co-movements of the items in the CPI may also signal broad-based price pressures, for the indicator captures how much disaggregated CPI prices are moving in sync. For example, fuel price increases in 2016-2017 led to increases in the prices of other goods and services, resulting in higher price co-movements. On a more recent observation, the highest reading in early 2023 of price co-movements largely reflected broad-based inflation, which eventually peaked when the economy gradually gained its recovery momentum amid the reopening period.

Chart 11. Co-movement In Price Changes of CPI Items
(covariance σ^2)



Note: The weighted covariance is calculated using the 4D CPI data on a month-on-month basis for a moving window of over 2 years. The weight is based on the multiplication of the CPI weights of a given pair of items, and the total covariance is the sum of the weighted covariance across all possible pairs of CPI items.

2.4 Relative Price Growth and Monetary Policy Challenges

2.4.1 Relative Price Adjustments

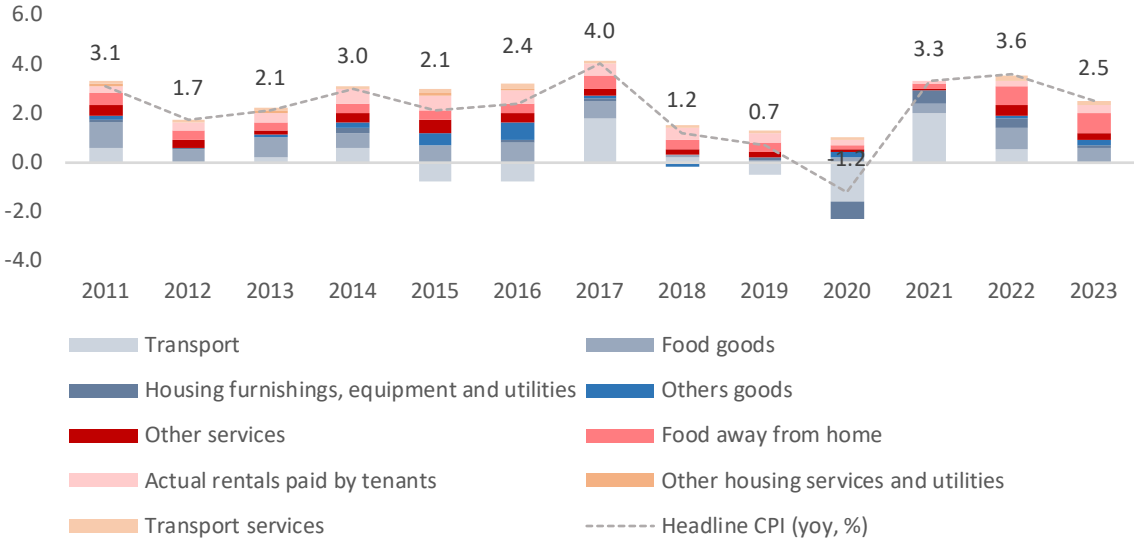
As inflation trended lower when the economy faced gradual disinflation throughout 2023, the decline in the relevance of broad-based price pressure was eventually replaced by the prevalence of sector-specific dynamics. By then, relative price adjustments had a stronger influence on price trends (i.e., relative prices may exhibit higher trends or higher contributions to inflation), although this does not necessarily alter the overall inflation path to a higher level beyond what is expected.

For example, adverse weather conditions can negatively affect fresh food production, and raw material shortages impeding furniture production can result in price adjustments in the respective sectors. The impact of these factors is typically contained within specific segments, and unless the shocks become prolonged and severe, they tend to be short-lived. Idiosyncratic inflation is largely sensitive to commodity-specific factors, which are predominantly influenced by supply-side issues, and monetary policy can be less effective in responding to these shocks.

2.4.2 Salient Relative Price Adjustments

This will remain true for most relative price adjustments, except when salient components of the CPI, namely fuel, food, and housing inflation, begin to show higher and persistent price movements (BIS, 2022). Historically, the coincidence of higher global fuel price periods with the price adjustments of retail fuel prices by the Government of Malaysia has translated into higher overall inflation (Chart 12).

Chart 12. Services and Goods Contribution to Headline Inflation
(percentage points, ppt)



Note that higher global fuel prices in 2011 and 2017 have led to higher inflation contributions from food goods and services, housing, and transport which gave rise to headline inflation.

This also corroborates with the historical evidence that suggests global energy price shocks are more likely to result in broad-based inflationary pressures (Table 13)

Table 13. Sources and Destinations of Global Shocks to CPI

Source of Shock: Global Commodity Prices			
Destination of shocks: CPI category	Global agriculture	Global metal	Global energy
Food & Non-Alcoholic Drinks			
Fuel, Electricity, Gas			
Alcoholic Drinks & Tobacco			
Clothing			
Housing			
Furnishing			
Health			
Transport			
Communication			
Recreational			
Education			
Restaurants & Hotels			
Miscellaneous			

Note:

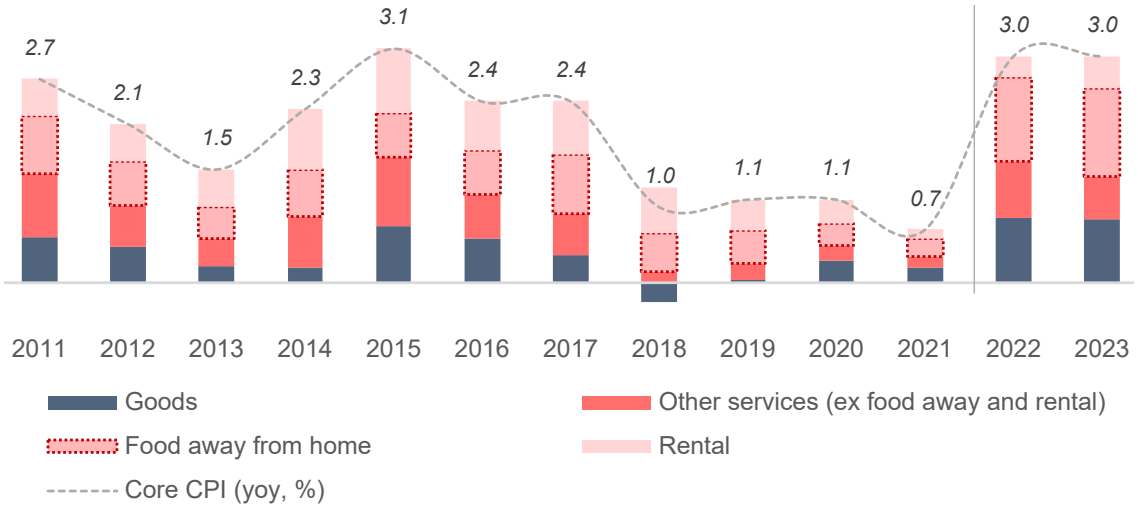
1. Share of the variance of CPI category price changes explained by respective global commodity price shock over a horizon of 12 months.
2. Sample period: 2011-2019.
3. Based on CPI weight 2018.

Given its salience and influence on production prices, adjustments in domestic fuel prices in response to global fuel price increases can pose risks to inflation, especially if the magnitude of price increases is sizable or the adjustments occur frequently. In anticipation of the Government's subsidy reform measures on fuel prices, continued surveillance on salient relative prices would help policymakers anticipate the risks of spillover effects to core inflation that could lead to more generalised price pressures and a level shift in the inflationary path.

2.4.2.1 Salient Relative Price Adjustments Post COVID-19

This also remains true for another salient component in CPI concerning food inflation. Until recently, food services (i.e., food away from home inflation) in Malaysia have been a persistent and significant contributor to core inflation since the COVID-19 reopening, which has induced higher-for-longer headline inflation towards the end of 2023. Between 2022 and 2023, food away from home contributed to about 40% of core inflation compared to 24% of the overall contribution to core between 2011 and 2019 (Chart 14).

Chart 14. Services and Goods Contribution to Core Inflation
(percentage points, ppt)



The number of shocks, along with the magnitude and duration of the shocks, as well as initial conditions of the economy in which the shocks occur, would matter. For instance, taking lessons from the pandemic crisis, economies have experienced a succession of large and relatively prolonged supply-side shocks, ranging from global supply-chain disruptions amid the pandemic to the Ukraine conflict, which, alongside stronger demand conditions, have resulted in significantly higher inflation globally.

These had induced the widespread propagation of price pressures domestically. Although past episodes of shocks usually arise from unique circumstances in particular industries or segments, the unprecedented, large, and persistent salient relative price adjustments in the CPI basket from pandemic-related disruptions eventually became pervasive and affected the overall inflation trajectory.

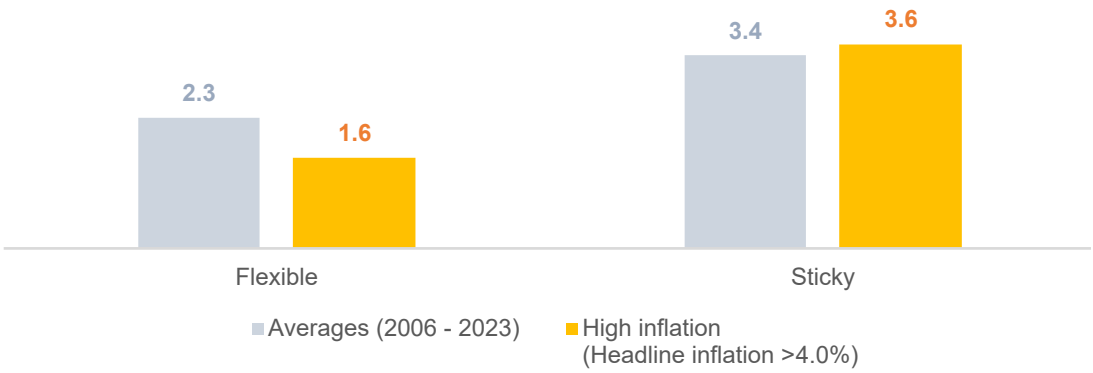
2.5 Inflation Persistence

In assessing the implications for monetary policy, a high inflation period can either be viewed as: i) a natural effect of adjustments in relative prices- especially after the economy is hit with uneven shocks- and as such, a necessary process that is temporary, where monetary policy action could afford some patience; or ii) becoming persistent which could potentially lead to second-round effects via higher inflation expectations, where policymakers should be more vigilant against prolonged periods of price increases, especially on salient relative price pressures such as fuel and food (Smets, on his comments for Guerrieri, et.al, 2024).

Salient price shocks drive inflation higher, altering agents' inflation perceptions, and prolonged inflation experiences heighten inflation expectations. Behaviourally, this leads firms to become more anticipatory of future shocks, making them more inclined to raise prices, including sticky prices that do not typically adjust in normal times (Chart 15).

Chart 15. Average Inflation by CPI "Stickiness"

(year-on-year, %)



Note: High inflation can cause prices to become more flexible, and this shift in inflation dynamics played a key role in the post-pandemic inflation surge. Typically, in a high inflation regime, the relationship between inflation and economic activity is estimated to strengthen by a factor of 1.2-3.5 times higher than that during normal periods. This alludes to inflation becoming more sensitive to cost and demand conditions with flexible prices.

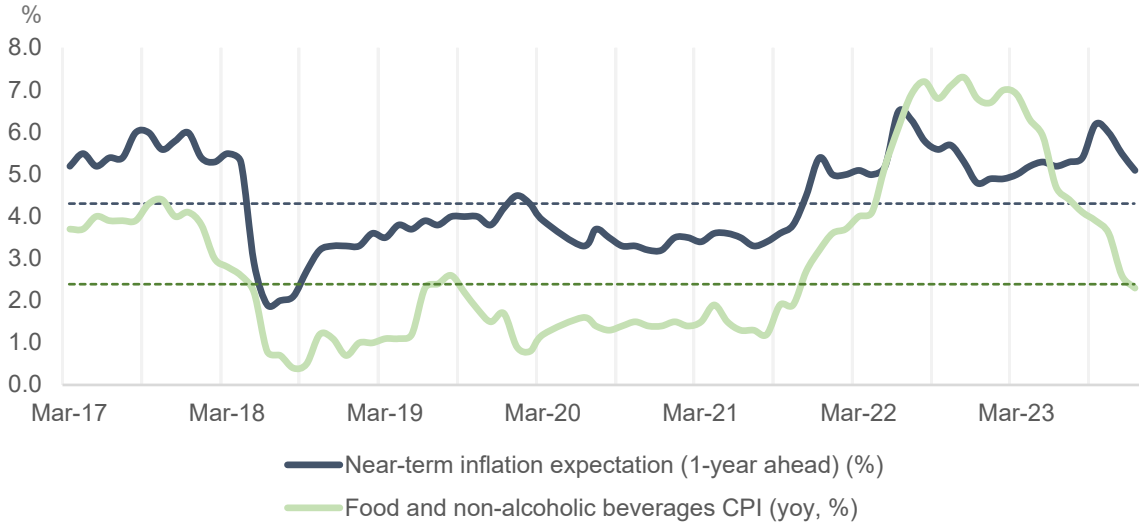
As agents, including households and markets, react more sensitively to inflation, a self-reinforcing cycle emerges, where persistent inflation feeds on itself. These dynamic risks, de-anchoring inflation expectations and, combined with strong wage catch-up, could potentially trigger a wage-price spiral.

Given these scenarios, although the supply shocks and the consequent volatility in fuel and food inflation are beyond the direct control of monetary policy, effective and timely action may be warranted to contain the generalisation of inflationary pressures, anchor inflation expectations, and help to keep the lid on cost-of-living concerns.

Monetary policy may shape and influence inflation expectations in response to the risks of inflation becoming unanchored. The change in policy rate can directly help to re-anchor inflation expectations and also indirectly influence expectations by reducing actual inflation via slower aggregate demand.

Near-term inflation expectations in Malaysia have generally moved in tandem with changes in food inflation, as households are particularly sensitive to price increases of frequently purchased items like groceries. Data on expectations reveal fluctuating trends rather than sustained level shifts, indicating that near-term inflation expectation is mean reverting (Chart 16). Notwithstanding this, while the persistently elevated trend in inflation expectations despite actual inflation cooling may indicate a structurally higher post-pandemic level, it could also partly reflect the heightened uncertainties among households surrounding inflation amid various structural reforms underway.

Chart 16. Inflation Expectations and Year-on-year Food and Non-alcoholic Beverages CPI



2.6 Inflation Convergence

One way to ascertain the impetus of a surge in global commodity price shocks, which may translate into the second-round effects in the domestic economy, is to observe whether core inflation converges toward headline inflation trends.

Supply-driven headline shocks are usually confined to a limited number of idiosyncratic items, such as specific commodities or sectors experiencing acute disruptions. In these situations, core inflation— which excludes these volatile items— usually remains relatively unaffected, leading to a divergence between headline and core inflation measures. In such cases, monetary policy intervention is typically less urgent, as the divergence is expected to resolve once the specific shocks dissipate and headline inflation realigns with core inflation.

Conversely, when a supply-driven shock has a broader impact, causing widespread price increases across various Consumer Price Index (CPI) components, core inflation may begin to converge with the headline measure. This occurs as the initial shock spreads through the economy, influencing a wider range of goods and services, and affecting the core inflation rate. This broader effect signals that inflationary pressures are becoming more entrenched and systemic, which poses a stronger case for monetary policy intervention. Addressing these widespread inflationary pressures promptly is crucial to stabilise the economy and prevent more persistent inflation.

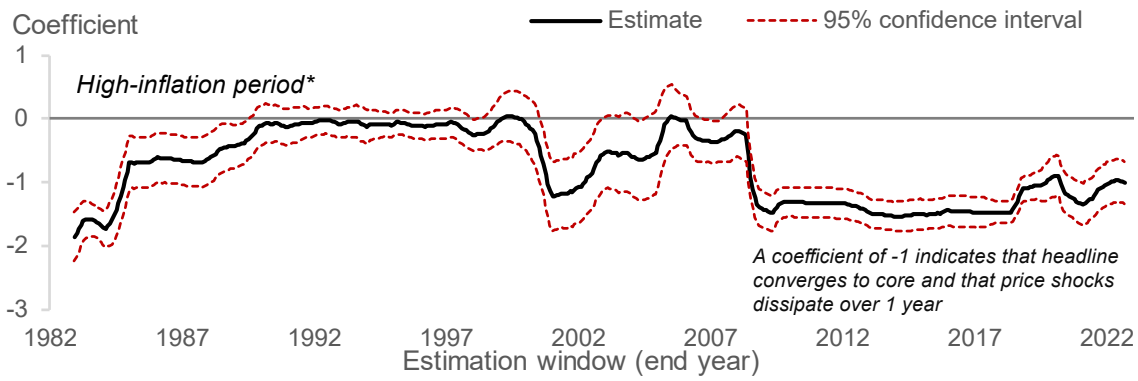
As a matter of concern, persistence could occur when the supply-side shocks are able to unhinge inflation expectations, as agents react to transitory adjustments such that the underlying inflation catches up with broad headline inflation (which is subject to volatility and seasonality). For Malaysia, while there is historical evidence to suggest that core inflation tended to converged towards headline inflation, the channels of transmission through which these adjustments occurred are not entirely clear, particularly given potential measurement issues.

Prior to 2007, the core CPI in Malaysia was computed to include all items of the CPI with the adoption of modified weights—higher weights were assigned to items that have low price volatility, and lower weights were given to items that have high price volatility—as a method to statistically reduce the significance of volatile prices from the CPI indicator, rather than removing them entirely, to measure underlying prices. Compared to exclusion-based core inflation, the modified-weight core measure was more susceptible to supply-side factors, causing the indicator to be more prone to increases and adjust closer to the headline inflation trend. This raises concerns regarding the effectiveness of the modified-weight method, which was employed to gauge underlying inflation trends between 1980 and 2007.

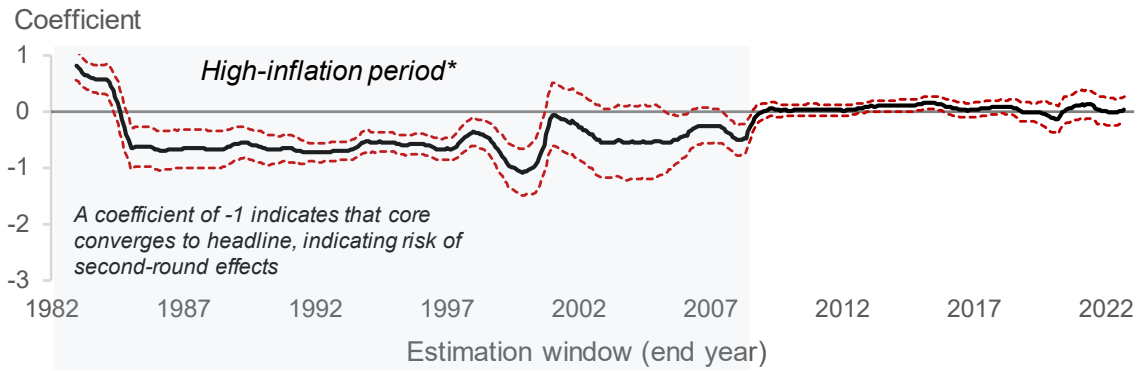
The exclusion-based core inflation has been officially used since 2007. There has been less evidence that core inflation converges with headline inflation. Instead, headline inflation has more consistently reverted to core inflation trends (Chart 17).

Chart 17. Convergence of Headline to Core and Vice-versa

Convergence of Headline to Core Inflation *(over 10Y moving window)*



Convergence of Core to Headline Inflation *(over 10Y moving window)*



Note: Core inflation estimated by excluding "Food and Non-alcoholic Beverages" and "Transport" sectors. The method is adapted from Borio, C., et al., "The two-regime view of inflation".
Source: BIS, 2023, Department of Statistics Malaysia; staff estimates.
* The high inflation period is assessed using the 5-year moving average, which refers to the period between Jan 1990 - and Dec 2007, with an average inflation of 3.1%.

This indicates that past global commodity price shocks have not led to persistent increases in headline inflation. These types of price shocks are usually transitory, which tend to dissipate after one year, with limited concerns on second-round effects as they are unable to bring about a sustained and prolonged increase in domestic prices. This could be partly due to the administered price mechanism implemented in Malaysia, which helps contain consumer prices from increasing.

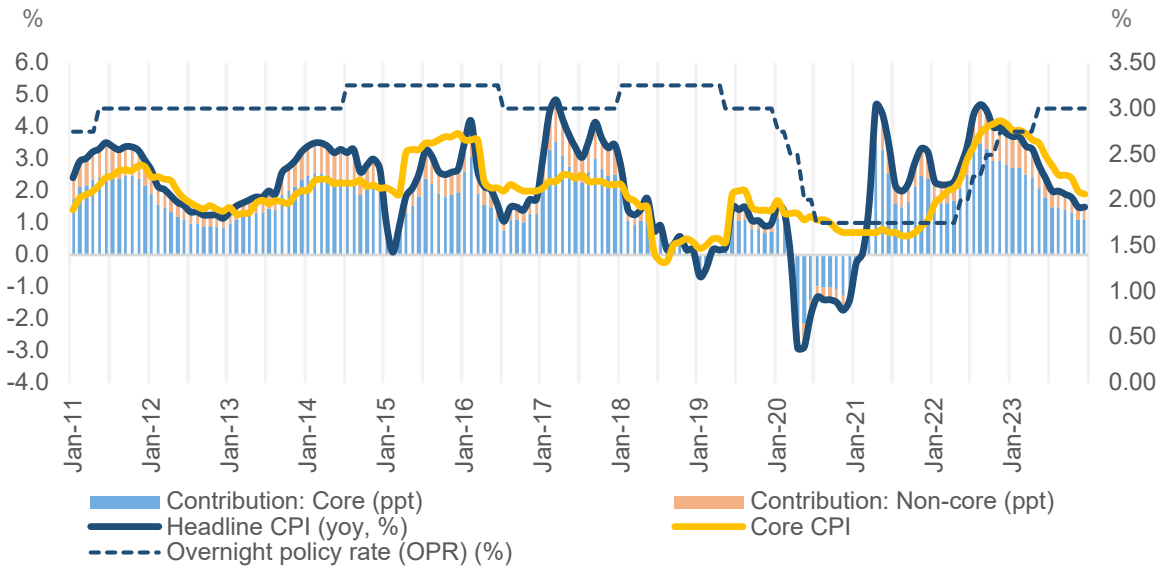
In addition, country-specific factors may influence the dynamics of inflation in the face of shocks, and these factors include: i) initial inflation condition (whether the inflation level was high or low when shocks hit); ii) the weight of food and fuel-related consumption in CPI; and iii) the institutional quality, either owing to structural features or execution of public policies by authorities or both. To elaborate on the final aspect; core inflation in Malaysia has remained relatively stable with limited risks of second-round effects observed. This is reflecting in part structural issues in the labour market surrounding the low prevalence of wage indexation and wage bargaining, which causes a weak relationship between higher prices and the subsequent wage catch-up.

Notwithstanding the indirect positive implications on inflation, there is growing concern that the limited practice of wage bargaining in Malaysia has restricted the ability of wages to increase. This has caused households to struggle to cope with rising inflation as income growth has not kept pace with the increasing cost of living. Given this, proactive efforts by the Government to attract high-quality investments to create high-paying jobs, upskilling, and other initiatives to increase wages are crucial to improve the economic prospects and the people's welfare in achieving sustainable and equitable growth.

2.7 Regime Shifts and Monetary Policy

Although we consider regime shifts a remote tail risk in Malaysia's inflation dynamics, it is worth exploring how these considerations shape our approach to monetary policy moving forward. As monetary policy normalised post-pandemic, the economy experienced gradual disinflation between 2022 and 2023 following a cumulative 125 bps policy rate hike by BNM from May 2022 to May 2023 (Chart 18).

Chart 18. Headline CPI, Core CPI and Overnight Policy Rate (OPR)



As inflation eased towards the end of 2023, it is argued, based on the experience in the advanced economies, that monetary policy in a low-inflation environment can, for several reasons, afford moderate inflation deviations from its historical trends.[7]

General price level changes at a low rate are usually dictated by idiosyncratic factors and transient supply-side forces. In such an environment, indicators such as headline inflation that embed volatile prices tend to be a poor guide to future inflation. Narrower measures, such as core inflation, provide more precise signals. Given sector-specific dynamics and the uneven impact of idiosyncratic drivers on sectors, agents would now pay less attention to headline inflation, so much so that the expectations of higher prices become less of a pervasive influence on economic and financial performance to affect their behaviour or their price and wage-setting significantly.

Notwithstanding this flexibility, it is important to highlight that BNM remains vigilant on the domestic and external risks to inflation in the near term, stemming from the extent of spillover effects from domestic policy measures and external developments on global commodity prices and the financial markets. It is the period of potential transition from a low to a high inflation environment that authorities face the toughest challenge in interpreting inflation indicators.

To help policymakers navigate these dynamics, on top of broad inflation measures such as headline and core as well as model-based forecasts, granular inflation data can offer useful signals of an ongoing transition from low to high inflation regime. Indicators on sector-specific price changes help identify their common component, which is in itself a measure of underlying inflation. Measures of similarity in price changes across sectors can also give a sense of the breadth of inflationary pressures. Additionally, insights from the various measures of underlying inflation can provide more nuanced perspectives that

7. In the context of AE, deviations are relative to their respective inflation targets.

contribute to a greater understanding of price dynamics in Malaysia. While these measures may diverge, investigating the factors for deviations can reveal additional insights into the nature of the price dynamics at hand. Coupled with deeper evaluations of broader macroeconomic conditions, this approach allows for a clearer signal of underlying inflation (for more details, refer to the 2023 BNM Economic, Monetary and Financial Developments, Box Article, 'Underlying Inflation at its Core').

The effectiveness of monetary policy to control inflation works with some lags, which necessitates a gradual, measured, and timely policy response before threatening risks which can lead to the transition to a high-inflation regime occur. This lag underscores the importance of a cautious and well-timed approach to monetary policy adjustments. To contain potential risks and avoid a shift towards a high-inflation regime, policymakers must act pre-emptively to ensure a gradual, measured, and timely policy response. By responding early, monetary authorities can steer the economy towards stability more effectively, ensuring that inflation remains under control without triggering excessive disruptions in the economy.

3. Conclusion

Price stability is essential for achieving a sustained growth path in Malaysia. It creates a conducive economic environment that encourages investment, consumption, and long-term financial planning. The coordinated policy mix between the Government and BNM has been instrumental in maintaining this stability. The concerted efforts of fiscal and monetary policies have ensured that inflation remains within a manageable range amid several episodes of fluctuating commodity prices and economic disruptions.

As a measure of inflation, the CPI remains a reliable measure of domestic aggregate price changes. The indicator tracks the cost of a basket of goods and services over time, providing valuable insights into broad price trends. While the CPI does not capture nuances that are important for inflation—such as quality changes, shifting consumption patterns, and regional price disparities—it is widely used because of its comprehensiveness and accessibility, and it remains a key indicator for gauging the overall health of the economy. Policymakers rely on CPI data as a valuable baseline for understanding inflationary pressures to make informed decisions about policy rates, wages and price-related social programmes, making it an essential tool for understanding and managing the economy.

Empirical evidence highlights the importance of monetary authorities understanding the underlying inflation dynamics to ensure policy action is taken while it is effective. To do so, it is crucial for policymakers to differentiate between broad-based inflation, which affects a wide array of goods and services, and sector-specific inflation, which affects only certain segments of the economy. Following that, recognising whether the economy is operating in a low-inflation or high-inflation environment (or regime) allows for more tailored (i.e., gradual, measured, and timely) policy interventions. This nuanced approach ensures that policy actions are efficient, helping to keep inflation low and stable and maintain overall economic stability.

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Appendix

Table A. Population Coverage

	Location	Population	Weight	
Year	Region Classifications	Census	Urban	Rural
2006	1. Northern zone 2. Eastern zone 3. Middle zone 4. Southern zone	2000 census		
2010	1. Pulau Pinang 2. Perlis and Kedah 3. Perak 4. Pahang 5. Terengganu 6. Kelantan	2010 census		
2016	7. Wilayah Persekutuan Kuala Lumpur 8. Wilayah Persekutuan Putrajaya and Selangor 9. Negeri Sembilan 10. Melaka 11. Johor 12. Wilayah Persekutuan Labuan and Sabah 13. Sarawak			
2022	1. Pulau Pinang 2. Perlis 3. Kedah 4. Perak 5. Pahang 6. Terengganu 7. Kelantan 8. Wilayah Persekutuan Kuala Lumpur 9. Wilayah Persekutuan Putrajaya 10. Selangor 11. Negeri Sembilan 12. Melaka 13. Johor 14. Wilayah Persekutuan Labuan 15. Sabah 16. Sarawak	2020 census		

Table B. Source of Weights for CPI Items and Retail Coverage

Year	Source of Weight calculations	No of HH Sampled in HES	Price Locations (No. of outlets)			Coverage (%)	
			Peninsular	Sabah	Sarawak	Urban	Rural
2010	Household Expenditure Survey 2006 *(conducted from June 2004 to May 2005.)*		20,000	2,200	2,400	64	36
2011	Household Expenditure Survey 2010 *(conducted from April 2009 to March 2010)* *Note: The weights had been retained despite the issuance of HES 2012*		24,000	3,500	2,600		
2012							
2013							
2014							
2015							
2016	Household Expenditure Survey 2014 (*conducted from January to December 2014).*						
2017							
2018	Household Expenditure Survey 2016 (*conducted in 2016).* *Note: The weights have been unchanged in recent years despite the issuance of HES 2019 and 2022.*	89,000	17,000	2,500	2,300		
2019							
2020							
2021							
2022							
2023							

Table C. Items Covered in the 2023 Festive Season Price Ceiling Scheme

	2023 Festive Season Price Ceiling Scheme
Eid-ul Fitr	1. Fresh (meat, beef) 2. Fresh fish (Selayang fish, mackerel, tuna, Demudok fish *(not in the CPI) basket)*) 3. Fresh vegetables (tomato, fresh red chilli, round cabbage, long beans, cucumber, green mustard, ginger, onions, potato, dried chilli, garlic, coconuts) 4. Ground nuts
Chinese New Year	1. Pork 2. Fresh fish and seafood (white pomfret *(not in the CPI basket),* prawn) 3. Fresh vegetables (garlic, potato, round cabbage)
Deepavali	1. Imported mutton 2. Fresh vegetables (Onions, fresh red chilli, coconuts, tomato) 3. Lentils *(not in the CPI basket)*

Table D. Inflation Perceptions Definitions and Construction of Index

<table>
<tr><th>Inflation Perceptions</th><th>Definition and Construction of Index</th></tr>
<tr><td>Everyday Price Index (EPI)</td><td>The index comprises frequently purchased goods and services (at least once a month) that incorporate the frequency bias. It excludes infrequently purchased and big-ticket items such as clothing, household appliances, and holiday expenses. Items, for which prices are contractually fixed with less frequent adjustment, such as rentals, are also excluded.
<table>
<tr><th rowspan="2">Categories</th><th colspan="2">Weights</th></tr>
<tr><th>CPI</th><th>EPI</th></tr>
<tr><td>Food and non-alcoholic beverages</td><td>30.2</td><td>50.2</td></tr>
<tr><td>Clothing and footwear</td><td>3.3</td><td>0.0</td></tr>
<tr><td>Housing and utility</td><td>23.8</td><td>7.0</td></tr>
<tr><td>Furnishing</td><td>3.8</td><td>1.5</td></tr>
<tr><td>Health</td><td>1.7</td><td>0.0</td></tr>
<tr><td>Transport</td><td>13.7</td><td>15.8</td></tr>
<tr><td>Communication</td><td>5.2</td><td>7.8</td></tr>
<tr><td>Recreation</td><td>4.9</td><td>5.9</td></tr>
<tr><td>Education</td><td>1.1</td><td>1.6</td></tr>
<tr><td>Restaurant and hotel</td><td>2.9</td><td>4.1</td></tr>
<tr><td>Miscellaneous</td><td>6.5</td><td>2.0</td></tr>
<tr><td>Total</td><td>100.0</td><td>100.0</td></tr>
</table></td></tr>
<tr><td>Perceived Price Index (PePI)</td><td>Imputed from EPI where it attempts to incorporate the memory bias in addition to the frequency bias. Items in PePI are exactly the same as EPI. However, the index will only capture price increases, as consumers tend to disregard price declines. Price indices that are registering declines are assumed to be unchanged.</td></tr>
</table>

Table E. Price Administered Items in the CPI Basket According to Category (as at 2023)

6- digit items with price controls	Weight (%)	4-digits class in the CPI compilation
5 % broken local rice	0.6	**0111 Rice** *(5 % of broken local rice is grouped with glutinous rice, 10% broken local rice, 15% broken local rice, fragrant local rice, imported rice, imported fragrant rice, and basmati rice which are not covered by Government subsidy or price control programmes)*
Cooking oil	0.3	**0152 Oils** *(Subsidised cooking oil is grouped with non-subsidised cooking oil, and other oils which are not covered by Government subsidy or price control programmes)*
Wheat flour	0.2	**0112 Flour and other cereal grains** *(Wheat flour is grouped rice flour, oats, wheat base cereals and other pre-cooked cereals which are not covered by Government subsidy or price control programmes)*
Hen's eggs	0.3	**0144 Eggs** *(Hen's eggs are grouped with salted eggs which is not covered by Government subsidy or price control programmes. However, only standard eggs are subsidised)*
Sugar	0.18	**0181 Sugar** *(White sugar is grouped with brown sugar, which is not covered by Government subsidy or price control programmes.)*
RON 95	7.6	**0722 Fuels & lubricant and other personal transport equipment.** *(RON 95, RON97 and Diesel are grouped with motor oil, engine oil, and other personal transport equipment which are not covered by Government subsidy or price control programmes)*
RON 97	0.6	
Diesel	0.3	
Domestic electricity	2.7	**0451 Electricity** *(Domestic electricity is subject to Government subsidy programmes*
Train fares	0.01	**0731 Rail Passenger Transport** *(The category covers the items that are fully subject to Government subsidy or price control programmes)*
LRT fares	0.01	
Commuter fares	0.01	

6- digit items with price controls	Weight (%)	4-digits class in the CPI compilation
Bus fares within a town	0.1	**0732 Road Passenger Transport** *(The category covers bus fares within a town, school bus fares, and long-distance bus fares, which are partially subject to Government subsidy programmes, as well as taxi fares within towns for which the price is not controlled)*
School bus fares	0.2	
And long-distance bus fares	0.02	
Airfares for domestic travel	0.07	**0733 Air Passenger Transport** *(The category covers airfares for domestic travel whose price is partially subject to Government subsidy programmes and airfares for international travel at market price)*
Sea transport services	0.03	**0734 Sea Passenger Transport** *(The category includes ferry/ship/boat fares which are subject to Government subsidy programmes)*

CHAPTER 7

INFLATION MEASUREMENT AND ITS IMPLICATION FOR MONETARY POLICY: CASE OF MONGOLIA

By

Lkhagvajargal Lkh[1], Chinzorig Ch[1], Khulan B[2], Enkhsaikhan U[2,3]

1. Introduction

Inflation is a critical economic indicator in Mongolia, directly influencing monetary policy and broader economic stability. As in many other countries, accurately measuring and understanding inflation is essential for effective policymaking. Hence, the Bank of Mongolia (BOM) has implemented an inflation-targeting framework.

Over the last decade, inflation rates in Mongolia have varied, with nationwide inflation averaging around 7.8% while Ulaanbaatar's (capital city) inflation averaged around 7.7%. During this period, high inflation has often been driven by rising prices of imported goods and domestic food products, which have contributed 36% and 22% respectively, at its peak. The country's reliance on agriculture exposes it to seasonal and weather-related volatility, and its dependence on imported goods –including fuel and essential consumer products– heightens its exposure to global price fluctuations. These factors collectively create persistent inflationary pressures.

This paper provides an in-depth review of the inflation measurement process in Mongolia, focusing on the calculation of the Consumer Price Index (CPI), from collecting price data across different regions to applying relevant methodologies. The analysis also considers underlying components of inflation, the key drivers behind its fluctuations, alternative inflation indicators such as the GDP deflator and the Producer Price Index (PPI) to offer a broader perspective on price movements within the Mongolian economy.

Given that our inflation is largely driven by the rising prices of imports and domestic food, it is particularly sensitive to exchange rate movements and external shocks. The empirical component of this study uses Bayesian vector autoregression (BVAR) to examine the relationship between inflation and the exchange rate, offering insights into how external shocks and currency fluctuations shape inflationary trends. Ultimately, this paper will contribute to a better understanding of the challenges and opportunities in managing inflation within the unique context of Mongolia's economy.

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3. Opinions expressed in this paper are of the authors and do not necessarily correspond to the opinions of the institution they work for.

The following sections will cover the measurement process of the Consumer Price Index (CPI), the defining features of inflation in Mongolia, and an empirical analysis, followed by conclusions and policy recommendations.

2. Measurement of Consumer Price Index

The CPI is a widely used indicator with a fixed basket of goods and services for measuring inflation, guiding economic policy and monetary decisions. In 1991, the National Statistics Office (NSO) of Mongolia began reporting the CPI using the International Monetary Fund (IMF) method. Initially, the CPI for Ulaanbaatar city was used as a proxy for the national[4] CPI, with indices for provinces calculated and announced separately from 1997. Starting from January 2006, the national index[5] was calculated using a weighted average of household consumption expenses in both provinces and the capital (NSO, 2020).

Table 1. Base Year Changes of CPI in Mongolia

Base year	*1990*	*1995*	*2000*	*2005*	*2010*	*2015*	*2020*
Number of products	123	205	239	294	329	373	414
Categories	8	8	8	12	12	12	13

Source: NSO.

The goods and services in the consumption basket and their weights were previously updated every five years (Table 1). As of 2022, the consumer price index transitioned to the 2020 base and updates are scheduled every three years to reflect changes more frequently. The CPI, previously computed within 12 categories, now includes 13 categories with the addition of the insurance and financial services group. According to the 13 main categories of Classification of Individual Consumption According to Purpose (COICOP), the consumer price index is currently calculated for 414 goods and services nationwide, 404 goods and services in Ulaanbaatar, and 313 goods and services in the provinces on a monthly basis (NSO, 2022). In the next sub-sections, how the index is compiled for Mongolia will be discussed in detail.

4. Mongolia has 1 capital city (Ulaanbaatar), 21 provinces, within which there are 330 soums (small settlements).

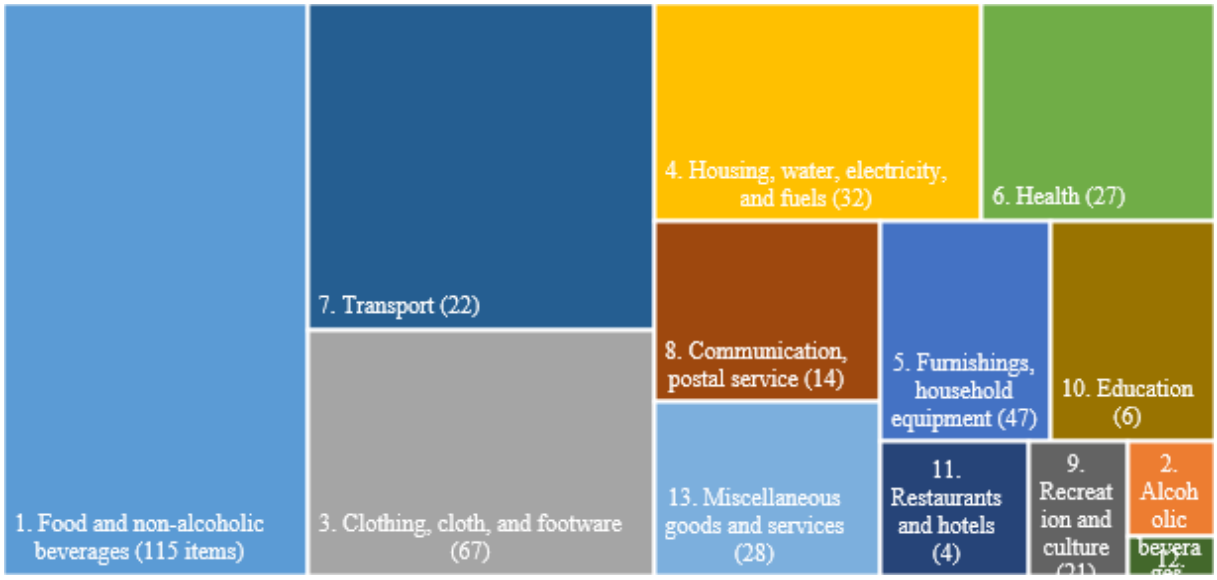
5. As of now, the methodology for calculating the Consumer Price Index, which uses the Laspeyres index, is outlined by the National Statistics Office order A/131 of August 19, 2022.

2.1 Expenditure Weights and Sampling of Outlets and Products

In Mongolia, the Household Socio-Economic Survey[6] (HSES) is the primary information source for selecting goods and services to be included in the consumer basket and determining their weights. From the survey, the total annual average monetary expenditure on these goods and services by households is calculated, excluding non-monetary outlays such as those from household farms, barter, donations, and assistance, etc. The share of each type of goods and services in the total annual expenditure is then computed for each province and the capital.

In the event of a significant change in the structure of household consumption due to a special situation (e.g. COVID-19) in the economy, or if the weight cannot be used for one year alone, the arithmetic average of the previous 2-3 years is considered. For instance, since the 2020 base CPI calculation reflects significant changes in consumer consumption patterns due to the COVID-19 pandemic, average results from the HSES conducted in 2018, 2019, and 2020 were used.

Figure 1. CPI Current Basket Weight, Percentage



Note: In Mongolia, the detailed breakdown of the weight of consumer basket products is not publicly available. The number of items are in brackets.
Source: NSO.

Figure 1 illustrates the weight of the basket's primary groups. More than 50% of personal consumption is attributed to three groups of goods and services: Food and non-alcoholic beverages, Clothing, footwear and cloth, and Transport. Additionally, over

6. The HSES is a nationwide survey that aims to estimate and monitor the level of poverty of the country and people's living standards. It updates consumption weights for the Consumer Price Index baskets and estimate private consumption expenditure for the national accounts (GDP) (NSO, statistic meta information, HSES).

46% of the total basket of products comprises imported goods, with the most significant contributions coming from the categories of food and non-alcoholic beverages, clothing and footwear, and housing, water, electricity, gas, and other fuels. This makes Mongolia's inflation particularly sensitive to fluctuations in the exchange rate of the MNT against foreign currencies and external shocks.

The CPI basket includes only goods and services that households regularly use, excluding items purchased for production purposes. To ensure accurate representation of consumer expenditures, the selection process for CPI items must have the following key criteria:

- **Household Consumer Goods and Services:** Goods and services must be commonly consumed by households.
- **Price Registrability:** Items must have recordable prices.
- **Market Availability:** Preference is given to products consistently available over a specified period.
- **Essential Representation:** Inclusion is based on the item's essential nature and its significance to overall consumption patterns.

Among the services included in the basket, the most complex one is the housing price. This is because housing, which can be new or old, is owned by households in different ways, such as renting, buying with cash or a loan, etc. Thus, calculating its weight can be complicated. So, the current basket includes only house renting price. These prices are collected and processed using the same methods applied to other goods. On the other hand, the housing price index, which reflects owner-occupied, new, and old housing, is published monthly by NSO separately. Data for this index is gathered from online advertising platforms and calculated using the hedonic regression approach.

2.2 Price Collection and Weight Adjustment

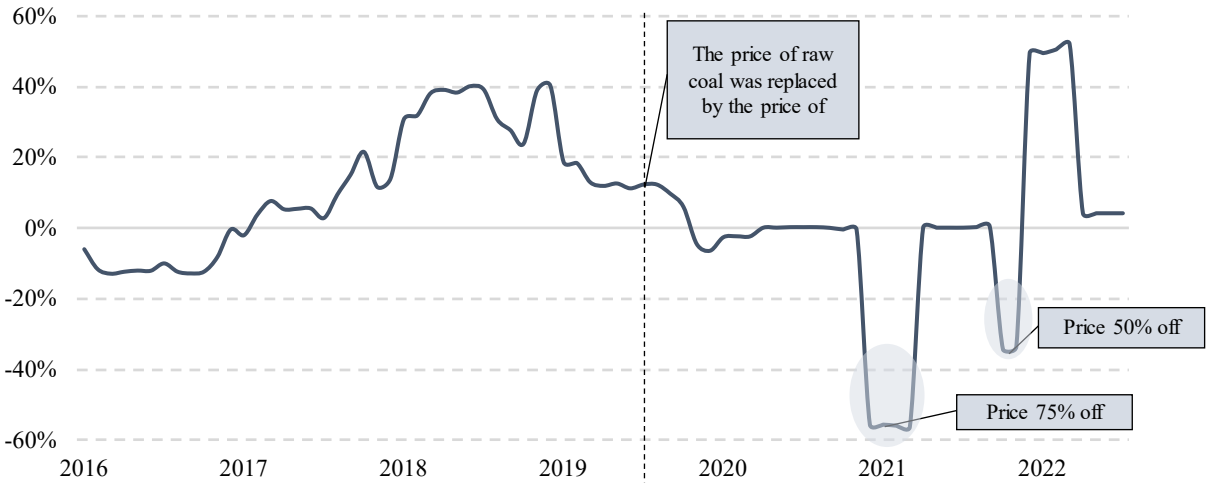
Price d ata form the foundation of CPI calculations. The NSO employs their own personnel and established standards for price collection, using both electronic devices such as tablets and paper forms. Data collection covers six districts in the capital city, provincial capitals, and selected 112 soums representing 70% of the provincial population (NSO, 2022). The sample for the price survey is updated whenever changes are made to the consumer goods and services basket, weights, or base years, ensuring the sample reflects current market conditions.

Selection of price collection points is based on population density, the variety of goods offered, and the frequency of business activity. In Ulaanbaatar, 5-6 prices per commodity are collected; 3-4 in provincial capitals; and up to 3 in soums. For service sectors like public transportation and healthcare, survey points prioritise businesses with the highest sales revenue. Prices are collected monthly from the 15th to the 21st, with more

frequent surveys for staple foods every 7 days, specifically on Wednesdays. Newly opened markets and shops may be incorporated into the monthly and 7-day price data if they attract a large population, offer diverse goods, and maintain regular operations.

Recorded prices include VAT but exclude additional services like delivery fees. Discounts, such as those during holidays, are recorded at their reduced values. When prices are unrecordable, the CPI calculation uses either the last recorded month's prices or replaces them with the group index. If prices cannot be recorded for over three months, the goods are replaced. This approach ensures consistency and accuracy in CPI calculation. For instance, in Ulaanbaatar, where air pollution is among the highest, the sale of raw coal was banned in May 2019, and refined coal was introduced. The price of coal in the 2015-based consumer price basket was adjusted accordingly. The price of refined coal was transferred to the coal price index of April 2019, and the index was updated based on subsequent changes in refined coal prices (Figure 2).

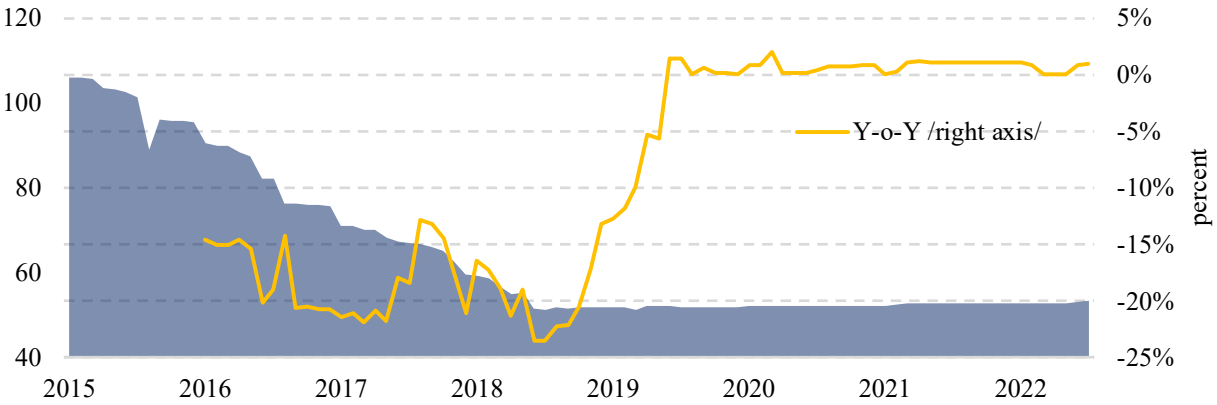
Figure 2. Coal Price Index



Note: Shaded areas indicate government measures to reduce refined coal prices: a 75% reduction from December 2020 to March 2021 to mitigate the pandemic's impact, and a further 50% reduction from October 2021 to March 2022 to support household income.
Source: NSO.

One of the biggest challenges in compiling the CPI is accounting for quality changes and adjustments in products and services. Certain goods, particularly electronics, experience rapid shifts in quality, making it difficult to represent them accurately in the consumer basket. In Mongolia, where the basket was updated every five years, this lag risked miscalculating price changes for rapidly evolving products. For example, the consumer price basket based on 2015 includes the Samsung Galaxy S2 model. Each year, the introduction of new models often causes older models to drop in price sharply, affecting overall inflation measurements (Figure 3). Such inaccuracies highlight the need for careful consideration when selecting products for the basket and emphasise the importance for timely updates. To address this possible issue, the NSO plans to update the consumer basket every three years, improving the accuracy of price indices due to technological progress.

Figure 3. Samsung Galaxy S2 Mobile Phone Price Index and Year-on-year Growth Rate



Source: NSO.

2.3 The Final Index

The NSO uses the Laspeyres index formula to calculate the CPI. The Laspeyres price index is commonly used when detailed consumption structure information is unavailable. The Laspeyres index formula is:

$$I_{ct}^{L} = \frac{\sum P_{it}\, Q_{i0}}{\sum P_{i0}\, Q_{i0}} \tag{1}$$

I_{ct}^{L} is the Laspeyres index for the c group (aggregate) in period t,

P_{it} is the price of commodity i in the reporting period,

P_{i0} is the price of commodity i in the base period,

Q_{i0} is the quantity of commodity i in the base period.

Equation (2) refines the Laspeyres index by considering the ratio of the sum of the quantity of goods and services in the base period at the prices of the reporting period to the total cost in the base period:

$$I_{ct}^{L} = \sum \left(\frac{P_{it}}{P_{i0}}\right) \frac{P_{i0} Q_{i0}}{\sum P_{i0} Q_{i0}} \tag{2}$$

Equation (3) represents the Laspeyres standard, incorporating price changes of basic products weighted by their share in total costs. It can also be expressed as:

$$I_{ct}^{L} = \sum \left(\frac{P_{it}}{P_{it-1}}\right)\left(\frac{P_{it-1}}{P_{it-2}}\right) \ldots \left(\frac{P_{i2}}{P_{i1}}\right)\left(\frac{P_{i1}}{P_{i0}}\right) \frac{P_{i0} Q_{i0}}{\sum P_{i0} Q_{i0}} \tag{3}$$

Equation (4), the modified Laspeyres index formula, is particularly useful when prices are not feasible to record, substitutions are necessary, or replacements for seasonal goods and services are required.

The national consumer price index is calculated using the following formula:

$$I_i^N = (E_i^1 * I_i^1 + E_i^2 * I_i^2 + \cdots + \sum E_i^j * I_i^j)/(E_i^1 + E_i^2 + \cdots + \sum E_i^j) \quad (4)$$

I_i^N is the country index for commodity i,

E_i^1 is the weight of consumption of commodity i in province 1,

I_i^1 is the price index of commodity i in the 1st province,

E_i^2 is the weight of consumption of commodity i in the 2nd province,

I_i^2 is the price index of commodity i in the 2nd province,

E_i^j and I_i^j represent the weight of consumption and price index of commodity i in the j th province, respectively, where j =1…22 for provinces and the capital code.

2.4 The Chained Index

Short- and medium-term projections of economic indicators are crucial for the monetary policy decision-making process. Econometric models are typically used by national central banks for projection purposes. The length of the data utilised in the model is the initial requirement for accurate and realistic results. CPI with a different base year must be transferred to a series with a single base year since Mongolia's consumer basket is revised every five years. The consumer basket for Mongolia was last updated in August 2023 to the 2020 base year. When connecting the consumer prices of various base years, the BOM uses the technique of extending the series by maintaining the monthly increase of the prices of previous basket products and groups (Figure 4).

Figure 4. Method of Calculating Chained Index

	…	*2019.10*	*2019.11*	*2019.12*	*2020.01*	*2020.02*	*2020.03*	*2020.04*	…
				0.2%					
Base 2015	…	119.3	119.7	120.6	120.9	121.7	122.3	…	
Base 2020	…	96.4	96.7	97.4	97.7	98.4	99.4	99.0	…
				0.2%					

Source: BOM.

Although the annual growth of the group transferred to the same base will match the annual growth of the previous base, it has some disadvantages. For example, after the series is extended by each group and the general index is weighted, the annual growth of the general index may not match the annual growth announced by the previous base, or

after the general index is extended by the above method, the sum of the contributions of the groups may differ due to change in weight of sub-groups.

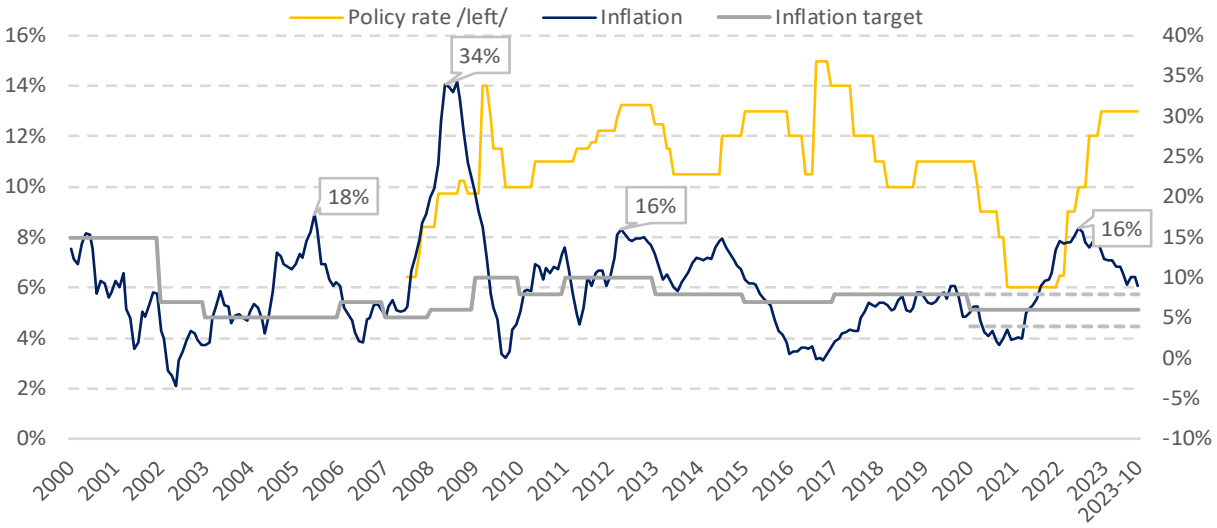
3. Inflation and its implication for Monetary Policy

The Central Bank Law (1996) outlines the primary objective of the Bank of Mongolia (BOM), which is to ensure the stability of the Mongolian Tögrög (MNT). Interpretations of this objective have varied, with some understanding it as maintaining low stable inflation and others as stabilising the exchange rate of the MNT against foreign currencies. However, the BOM explicitly aims to target inflation, regularly announcing targets and conducting policy measures aligned with this framework. The Monetary Policy Committee (MPC) meets quarterly to make policy decisions, with additional meetings convened in response to specific economic situations.

From the mid-1990s to 2006, the BOM targeted monetary aggregates. However, from 2006-2007, the dynamics of money outside the banks, money supply, and the money multiplier exhibited volatility, leading to a breakdown in the correlation between monetary aggregates and inflation. Consequently, beginning in 2007, the Central Bank shifted its primary policy focus from targeting monetary aggregates to utilising interest rates as the primary tool for steering monetary policy.

Inflation has consistently been a significant challenge for Mongolia, often exceeding the target set by the BOM, as illustrated in Figure 5. From 2011 to 2020, the BOM maintained a point target for inflation, such as 10% in 2011-2012 and 8% from 2013 to 2020. Starting in 2021, the target was modified to a range target, with the current goal being to stabilise inflation at 6%, +/-2% in the medium-term[7].

Figure 5. Inflation, Y-o-Y, 2000-2023



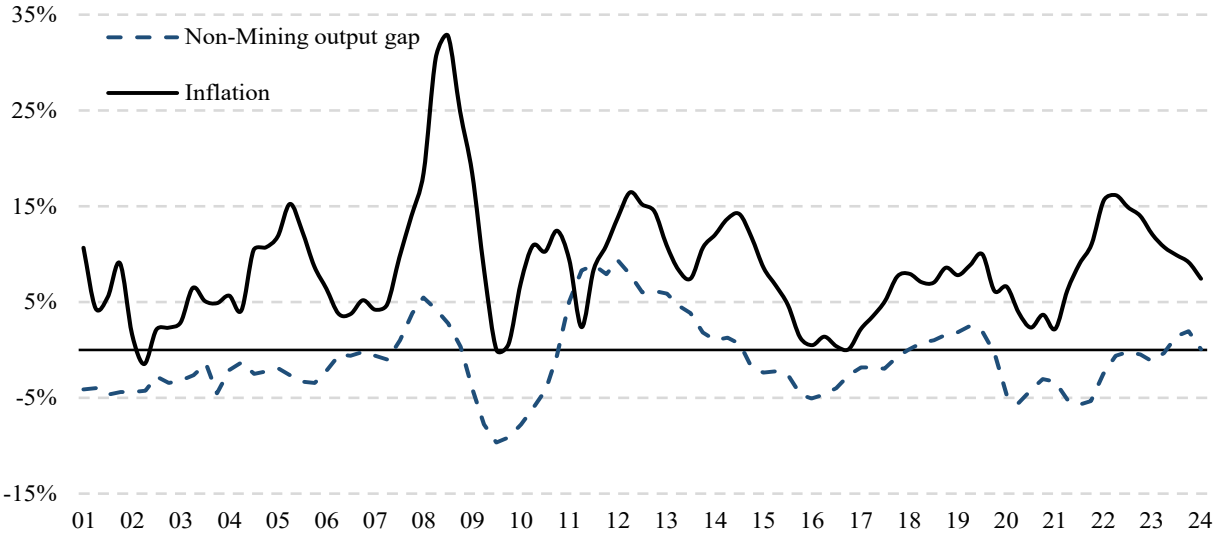
Sources: NSO, BOM.

7. The mid-term inflation target is determined by the Central Bank and approved by Parliament.

3.1 Drivers of Inflation in Mongolia

According to the historical statistics of the last 30 years, inflation in our country was relatively high and fluctuating as in other developing countries (Figure 5). As for the demand side, high government budget expenditures, increase in wage and favourable export conditions led to increased economic activity and an increase in domestic demand. Therefore, inflation driven by demand factors is in line with business cycles such as increasing during the economic overheat in 2013-2014 or dropping during the economic recession in 2016 and 2020 (Figure 6).

Figure 6. Non-mining Output Gap[8] and Inflation



Sources: NSO, BOM.

Imported goods[9] are important components of inflation, which makes up about 40% of the consumer basket. Also, its impact on inflation can be either demand or supply driven. Domestic demand shocks, which are mentioned above, and foreign exchange rates are the main demand drivers of imported goods inflation.

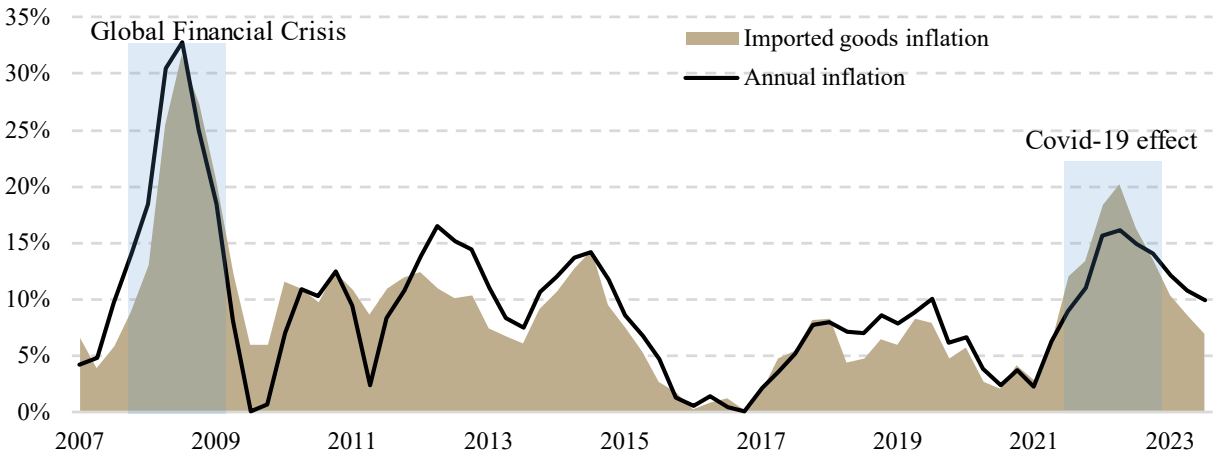
From the supply side, transportation, and foreign prices have a major impact on the price of imported goods. Mongolia is landlocked country and has only two big neighbours, China and Russia, and the majority of goods are imported from these two countries. Therefore, its change is highly dependent on the foreign trade policy and economic outlook of our neighbours, especially China. As for fuel, the stock and price of fuel is highly dependent on Russian oil and import related policies and international prices. For example, the brent oil price increased from November 2020 (US$48) and reached US$123 by May 2022 (Bloomberg). Due to the increase in fuel prices of the international market, domestic fuel prices increased sharply by 65% year-on-year in June 2022.

8. The Kalman filter was used to calculate the GDP trend.

9. Excludes foods.

Also, during the pandemic, when China implemented the Zero-Covid policy, which completely stopped the flow of people in and out of the country, the supply of imported goods was interrupted and prices began to rise. In addition, supply-side inflationary pressures continued to mount in 2022 due to the sharp increase in transportation costs worldwide. In June 2022, when the inflation rate reached its peak of 16.9%, the direct and indirect effects of imported goods accounted for 2/3 of inflation (Figure 7).

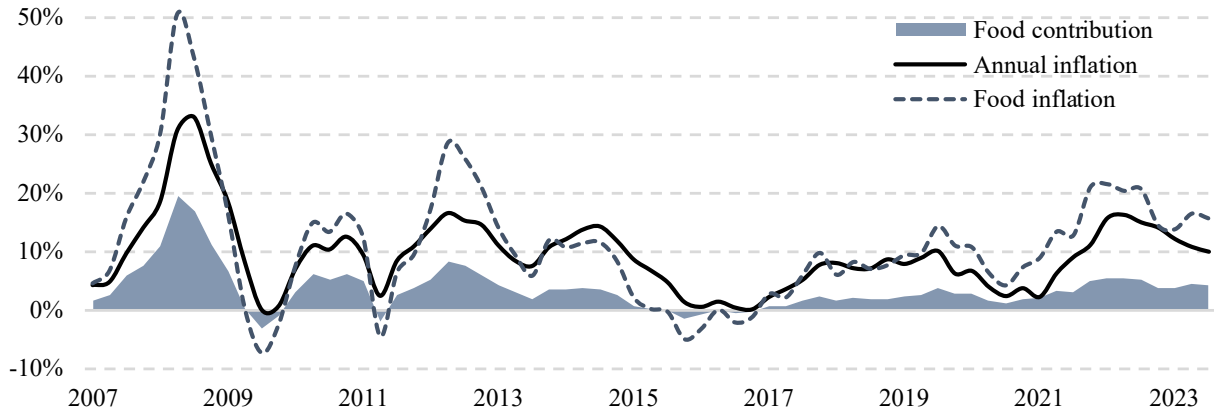
Figure 7. Imported Goods



Source: NSO.

One of the major supply shock is shortgage of agricultural food products in Mongolia. Despite accounting for less than 30% of the basket, food has a notable influence on changes in inflation (Figure 8). When it comes to food groups, the majority is made up of agricultural food products such as meat and meat products, flour, baked goods, milk and dairy products, and vegetables. The price of agricultural products depends on many force majeure factors such as rainfall and sudden dangerous weather events.

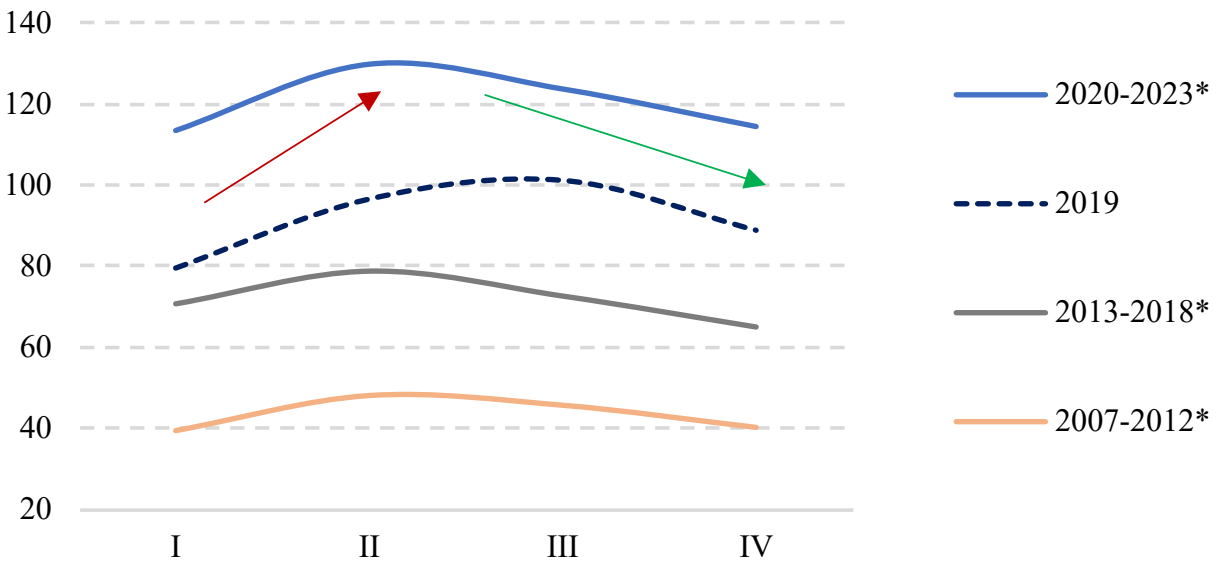
Figure 8. Contribution of Food in Inflation



Source: NSO.

The Mongolian agricultural sector has its own uniqueness. For instance, a greater part of the sector is livestock industry with herders being vital suppliers of the industry, especially for meat and dairy products. As herders lead a traditional nomad life, they are sensitive to sudden changes of weather and seasons. Thus, prices of meat and meat products as well as price of milk and dairy products fluctuate greatly and seasonally (Figure 9). The peak of slaughter season takes place in September-November, and depending on the weight of animals and winter consumption, the price of meat usually reaches the lowest level of the year at that time. However, in the winter and spring seasons, meat production is drastically reduced and the supply decreases, causing the price of meat to increase continuously in the first half of year. In addition, the price of meat depends on the summer and winter conditions of the previous year. When the pasture is in good condition with enough rainfall in the summer, the health of livestock will improve. Thus, livestock loss will be less in the winter and meat supply will be normal. On the other hand, if the winter is too harsh and there is a dzud[10], livestock loss will be severe and meat supply will suffer as a result. For instance, Mongolia experienced one of the harshest winters in decades during the 2023 – 2024 winter with over 5.2 million[11] livestock loss. Its consequence reflected on meat price which increased in 1st quarter of 2024 by 16% y-o-y.

Figure 9. Seasonal Pattern of Meat Prices



* the average of those years.
Source: NSO.

10. Harsh winter condition with heavy snow covers due to dominance of the Arctic climate.

11. It was about 8% of total livestock.

In addition, these supply shocks not only have a significant direct impact on inflation, but also an indirect effect on the prices of other goods and services through the production inputs and costs. For example,

1) an increase in the price of fuel will affect the price of other goods through transportation costs,

2) an increase in the prices of other imported goods[12] has an effect on prices through the increase of the input and costs of domestic goods and services, and

3) as the price of food rises, the price of related services such as catering service will increase, etc.

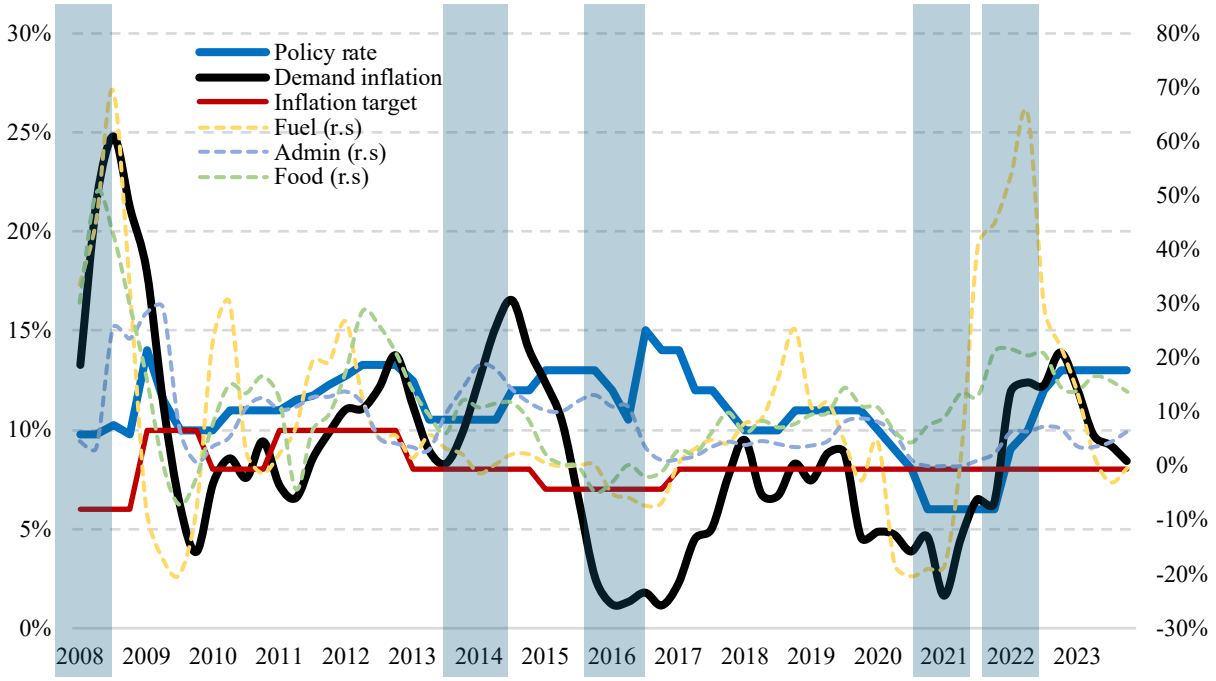
3.2 Impact of Monetary Policy on Relative Prices

As Mongolia is an inflation targeting country, its main goal is maintaining a low, stable inflation coupled with sustainable economic growth. The impact of monetary policy is felt after a certain period of lag, usually around 4 to 6 quarters later, on economic demand, activity, money supply, and thus prices (Enkhtaivan.L, Batsukh.Ts, Ariuntuul.B, 2017). The BOM thus aims to stabilise inflation in the medium-term rather than the current inflation. The monetary policy instruments of the Central Bank consist of policy rate, reserve requirements, open market operation and standing facilities. The Central Bank's main policy tool, the policy rate, affects inflation through the interest rates, public's inflation expectations, asset prices, and loans. For instance, an increase in the policy rate tends to decrease inflationary pressures, thus preventing overheating in the economy. On the other hand, the Central Bank can lower its policy rate to encourage loan issuance, investment and consumption when economic growth is slowing down (Figure 9). Demand-side inflation, which incorporates the effects of changes in economic activity, is less volatile than headline inflation and moves in line with economic growth. Therefore, the Central Bank aims to manage demand-driven inflation using its policy instruments. For the purpose of monetary policy analysis, demand-side inflation is calculated by subtracting food, administrated services[13], and fuel indices from headline inflation in BOM (Figure 10). It explains 65% of total inflation.

12. Excludes food and fuel.

13. Administrated services consist of services which the government and corresponding ministries oversee, such as electricity, water supply, and public universities.

Figure 10. Demand-Side Inflation[14] and Policy Rate Movement



Source: BOM.

As mentioned in the previous section, our country is prone to supply-driven price shocks. Therefore, whether the duration of the supply shock is long-term or short-term has an important impact on policy decisions, even as BOM's main focus is on demand-driven inflationary pressure. This is because, in addition to increasing current inflation, an excessively sharp or long-term supply shock can also increase inflation expectations and could have a second round effect on inflation. In this regard, the BOM and the government jointly implemented the "Price Stabilisation Programme" in 2012-2015 to stabilise the prices of construction, fuel, and agricultural products by making the supply and stock of these products stable, with the prime purpose of reducing high inflation driven by supply shocks. Also, in the first quarter of 2022, despite low demand-side inflation, the decision to increase the policy rate was made mainly due to supply-side factors such as border closure, delay of transport and logistics and high external uncertainty. The main objective of the decision was to prevent the additional increase in inflation expectations.

Since monetary policy tools have their limitations when it comes to supply shocks, the BOM principally focuses on open communication with the public to control inflation expectation during a supply-driven high inflation period.

14. Demand-side inflation is calculated by subtracting food, administrated services, and fuel indices from headline inflation.

3.3 Different Measures of Price Index and Their Trend

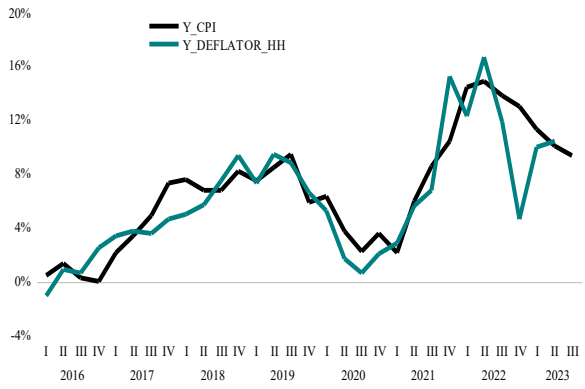
In addition to the CPI, other types of price indices are published quarterly by the NSO. Firstly, the GDP deflator is a quarterly index which is used to calculate real GDP from nominal GDP. It is an indicator which represents the price changes of total domestic goods and services. For Mongolia, as mining and agriculture are the main sectors of the economy, the GDP deflator is more volatile than the inflation. However, the household consumption sub-group has a relatively high correlation with inflation. In other words, both the deflator of household consumption and the inflation are representive of inflationary trends in Mongolia (Table 2, Figure 11).

Table 2. Correlation Between Other Price Indices and Inflation[15]

	GDP Deflator			*Producer Price Index*				
	household	government	capital	Industrial	Trade	Cater	Hotel	Trade (-1)
CPI Inflation	**0.86**	0.60	0.60	0.12	0.79	0.69	0.23	**0.82**

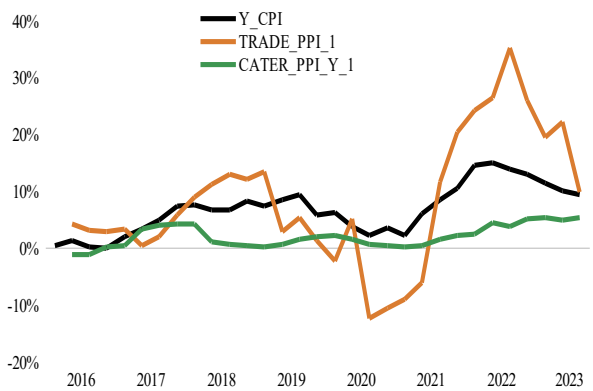
Source: BOM, researcher calculations

Figure 11. Inflation and Household Consumer Deflator



Source: BOM, Researchers' calculations.

Figure 12. Inflation and PPI of Trade and Cater Services (One Lagged)



Source: BOM, Researchers' calculations.

The producer price index (PPI) represents the change in the price of goods and services generated by the producer. The index, which has a 2015 base year, was first published by NSO in 2016. To calculate the index, information on the quantity and cost of the goods and services, industrial classification of all economic activities (ISIC), and central product classification (CPC) are used (NSO (2020)). Using the Laspeyres method, the integrated index is calculated quarterly for 5 sectors: hotel service, information communication, catering services, trade, and transportation, while the index of the industrial sector is calculated monthly.

15. Data range is 2015Q1-2023Q3.

Among these sectoral indices, the trade and catering sector indices have higher correlation with inflation (Table 2). Moreover, the trade sector index could be used as leading indicators of inflation because with its one-quarter lag, the correlation is higher and has similar movements to inflation (Figure 12). However, further study is needed to examine the relation between CPI and PPI in Mongolia's case.

The main purpose of analysing the relationship between other price indices and inflation is to determine the leading indicators of inflation for improving inflation analysis and projection. In this context, we have also started taking the first steps to calculate the E-CPI by collecting the prices of goods and services using web scraping methods from online shopping sites widely used in our country.

4. Empirical Analysis

In this section of the paper, we examine the impact of exchange rate on inflation using the BVAR model. Mongolia is heavily dependent on imports, with over 40% of the consumer basket consisting of imported goods. This reliance makes domestic prices particularly sensitive to fluctuations in the exchange rate of MNT against foreign currencies. Additionally, Mongolia's foreign reserves are largely dependant on its mining sector, the country's main export industry. As a result, the mining cycle can negatively affect the exchange rate. Therefore, it is significant to assess the impact of exchange rate movement on inflation in Mongolia.

In Mongolia, studies examining the impact of the exchange rate on inflation have produced varying outcomes. D. Gan-Ochir (2009) used a Recursive VAR model and found that the exchange rate of the MNT affects the CPI after a 3-month lag. B. Davaadalai and P. Avralt-Od (2010) observed that the impact of the exchange rate on inflation is asymmetric, with a monthly shock influencing inflation for up to 9 months. B. Dulamzaya and G. Amartuvshin (2020), using a TVP-VAR model, concluded that a 1% depreciation of the exchange rate leads to a 1.3 percentage point increase in inflation, an effect that persists for up to 24 months. Other studies have highlighted that the impact of exchange rate depreciation or appreciation varies depending on economic conditions (B.Munkhzul, 2014; B.Davaadalai & P.Avralt-Od, 2010; L.Davaajargal, The effect of exchange rate on inflation, 2015). L. Davaajargal (2015) found that when FDI increases and the exchange rate appreciates, the pass-through effect on inflation is minimal, at just 0.16%. However, in scenarios where FDI is withdrawn and economic activities slows, the exchange rate transmission effect is twice as large.

4.1 Data

The dataset used in the BVAR includes 13 variables and a dummy variable[16] for the period 2008Q1-2024Q1. Data before 2008 is not used because Barnett, Berch & Ojima (2012) analysed data from 2002 to 2011 and found no statistically significant effect of the exchange rate on inflation during that period. They concluded that, before 2008, the central bank tightly managed the exchange rate against the USD, limiting its variability and, consequently, its impact on inflation. The selection of variables for our model is based on the work of L. Davaajargal and D. Gan-Ochir (2018). Detailed explanations and illustrations of the variables are provided in Table 3. and Figure 13. Seasonal patterns of variables except monetary policy rate, loan interest rate, and share of total government expenditure in GDP were removed and logarithms were used in the model.

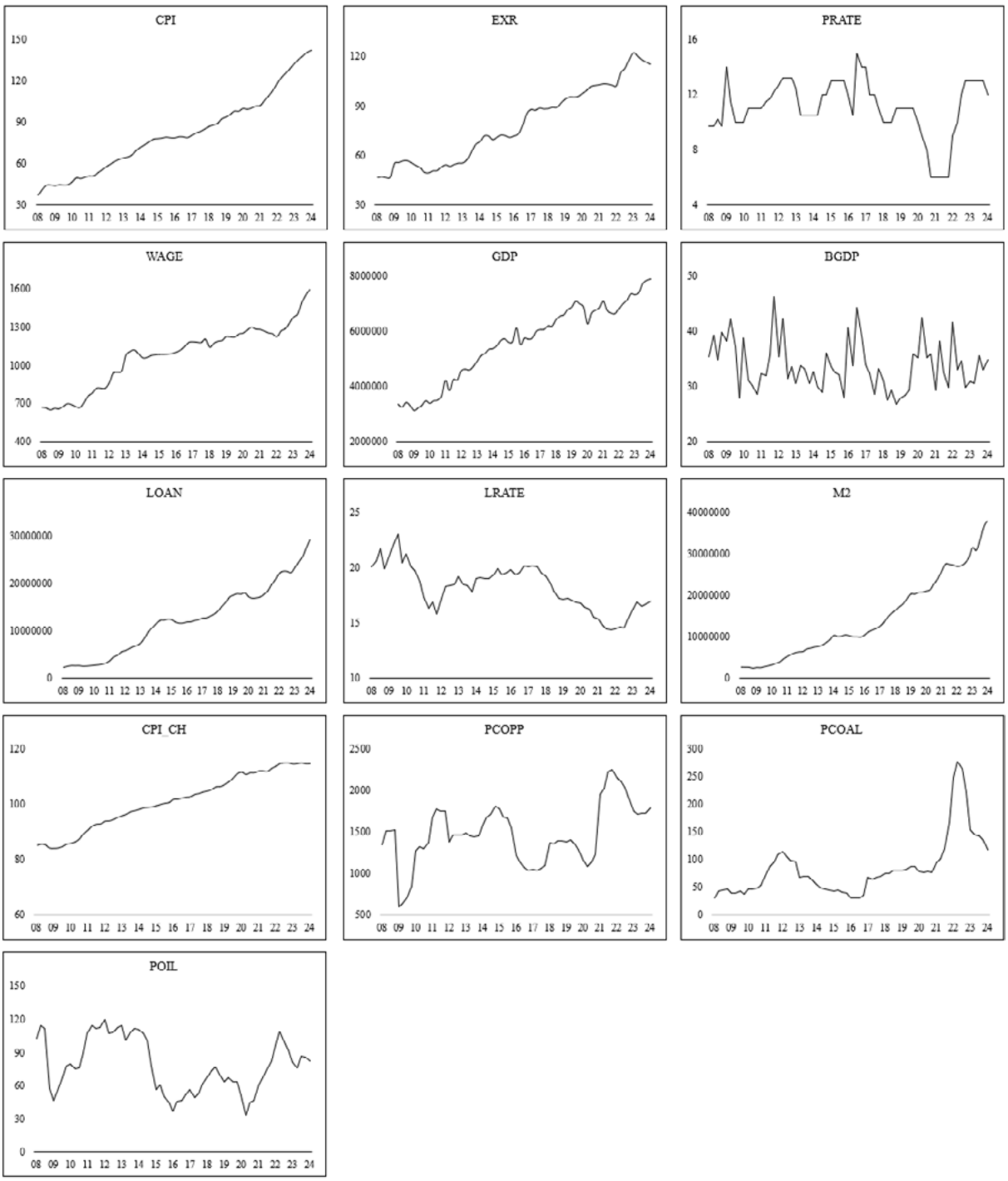
Table 3. Description of the Data

	Name	Description
1	cpi_t	Consumer Price Index, 2020=100, obtained from National Statistics Office.
2	exr_t	Weighted average of currencies (USD, CNY, RUB, EUR, JPY) against MNT primarily used for the Mongolia's imports. The Import Structure is used to derive the weight. and currencies data is sourced from the Bank of Mongolia.
3	$prate_t$	Policy rate of Bank of Mongolia, Before July 2007, Bank of Mongolia's policy instrument was aggregate money supply, so we substitute policy rate by Central Bank's bond rate before this period.
4	$wage_t$	Monthly real national average wage adjusted by CPI.
5	gdp_t	Real Gross Domestic Good, base year 2015.
6	$bgdp_t$	Share of government total expenditure in GDP.
7	$loan_t$	Outstanding loan amounts, million MNT.
8	$lrate_t$	Average loan interest rate
9	$m2_t$	M2 money supply, million MNT
10	cpi_ch_t	China's Consumer Price Index, 2005=100.
11	$pcopp_t$	Mongolia's copper export price, USD per ton
12	$pcoal_t$	Mongolia's export coal price, USD per ton
13	$poil_p$	World crude oil, WTI, USD per barrel

Sources: BOM, NSO and World Bank National Bureau of Statistics of China.

16. Global Finance Crisis (2009), commodity price crisis (2016) and Covid-19 (2020).

Figure 13. Variables Used in the Model. 2008Q1-2024Q1



Sources: BOM, NSO and World Bank National Bureau of Statistics of China.

4.2 Methodology and Result

Although vector autoregressive (VAR) models are emerging as a standard method for structural analysis and forecasting, when the number of variables in the model increases or chosen lags are high, the number of parameters for estimation in the model becomes excessive. Litterman (1986a) has shown that reducing the degrees of freedom of the model can lead to spurious estimation results with higher estimation errors.

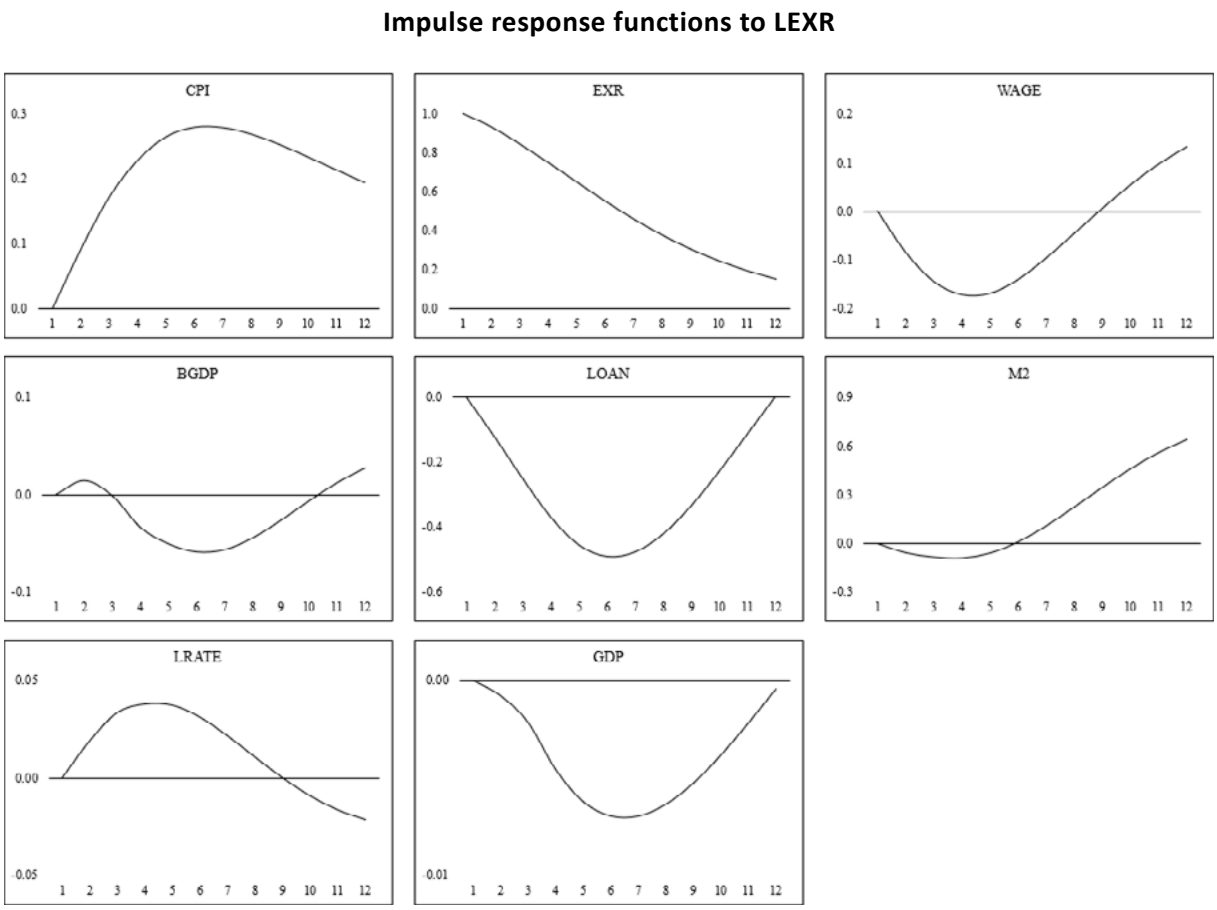
The Bayesian approach (BVAR), on the other hand, takes into account the uncertainty of the structure of the original set and does not give a high "weight" to that one value of the model parameter (no direct zero restrictions are placed on the coefficients), so that a relatively high number of variables can be left in the system. Litterman (1986a) showed that this uncertainty can be captured by the prior probability distribution of the model parameters and that posterior estimates of the VAR model parameters can be obtained. In other words, the Bayesian shrinkage (prior information about parameters) has become a possible solution to the problem of 'over-parameterisation'.

We estimated the BVAR model using the standard method Minnesota prior, which assumes that each variable follows a random walk process, possibly with drift (Litterman, 1986a). This involves placing a normal prior on a set of parameters with a fixed and known covariance matrix. Since this study used numerical data with quarterly frequency, the lag[17] of the BVAR model was chosen to be lag = 4.

According to the results of our BVAR model, wages, exchange rates, and loan rate have a high impact on inflation, while loan and budget expenditures have a low impact. When the exchange rate index used in the model increases by 1.0% (depreciation of MNT), the annual inflation increases by 0.26% after 4 quarters. In other words, the depreciation of the MNT leads to a rise in the cost of imported commodities as well as an increase in the cost of domestic goods and services due to increased production input costs. This result is familiar to that of G. Bumchimeg, B. Undral, B. Dulamzaya, & B.Tsend-Ayush, (2013) and D. Gan-Ochir & L. Davaajargal (2017).

17. When lag is changed to 2, the results of the study are similar to chosen lag in the model.

Figure 14. Impulse Response to Exchange Rates One Percentage Point Shock



Source: Researchers' calculations.

5. Conclusion

In conclusion, Mongolia's CPI measurement methodology has evolved significantly since its inception in 1991, aligning with international standards and adapting to economic changes. The transition to more frequent updates, now every three years, and the inclusion of additional categories such as financial services ensure that the index reflects current consumer behaviours. Despite challenges like quality adjustments and external price fluctuations, the NSO's use of the Laspeyres index and chained indices provides a robust framework for calculating inflation.

Over the past 30 years, Mongolia's inflation has been high and fluctuating, with imported goods and domestic food products contributing significantly. These two categories make up two-thirds of the consumer basket and indirectly affect other prices, such as transportation and services. Food prices, especially for agricultural products like meat and dairy, fluctuate seasonally due to the country's reliance on livestock and vulnerability to weather conditions. Imported goods are impacted by transportation costs, foreign prices, and trade policies, particularly with China. Mongolia's inflation-targeting monetary policy primarily manages demand-driven inflation, although supply-side shocks, such as those

experienced during the pandemic and in harsh winters, also influence policy decisions. Other price indices, like the GDP deflator and Producer Price Index (PPI), especially the PPI has relatively similar movements with inflation which shows that the PPI could be used as a leading indicator for inflation analysis and forecasting.

As mentioned before, Mongolian inflation is particularly sensitive to the foreign shocks and weather related events. Empirical results from the BVAR model covering 13 variables for the period 2008Q1-2024Q1, show that a 1% depreciation in the foreign exchange rate increases inflation by 0.26% after 4 quarters. Further, the change in the policy rate is reflected on inflation after 2 to 3 quarters. This result is consistent with the other literature in Mongolia. In this study, the symmetric effect of exchange rate pass-through on inflation was analysed. Hereafter, the analysis can be extented by examining whether there is an asymmetric effect of the exchange rate by including time-varying parameters to provide more detailed analysis of the relationship between exchange rates and inflation in Mongolia.

These insights underscore the importance of maintaining a flexible and responsive monetary policy framework, as the country continues to navigate both domestic challenges and external economic shocks. Continued refinement of the CPI and its components will be essential for supporting effective economic policymaking.

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ABBREVIATIONS	DEFINITION
BOM	Bank of Mongolia
NSO	National Statistics Office
CPI	Consumer Price Index
PPI	Producers Price Index
HSES	Household Socio-Economic Survey
MNT	Mongolian Tögrög (Mongolian currency)
COICOP	Classification of Individual Consumption According to Purpose
MPC	Monetary Policy Committee
BVAR	Bayesian Vector Autoregression

CHAPTER 8

INFLATION MEASUREMENT AND ITS IMPLICATION FOR MONETARY POLICY IN NEPAL

By
Suman Neupane *and* **Rabindra Maharjan**[1]

1. Introduction

Price statistics in Nepal has a long history. The beginning of price collection in Nepal can be traced back to 1902 when "Gorkhapatra", the first newspaper of Nepal began to collect and publish retail prices of a few commodities (NRB, 1981). Nepal Rastra Bank began collecting prices of essential consumer goods in a systemic way since its establishment in 2013 B.S. (NRB, 2005).

NRB is systematically collecting price data since its establishment, with its first weighted price index published in 1973/74 based on a first nationwide household budget survey in the year 1972/73. Over time, inflation measurement follows international best practices in terms of price collection, data quality management, calculation and dissemination. Thus, price statistics in Nepal has a long history of more than five decades with the compilation of the Consumer Price Index (CPI) since 1973. Unlike, other country practices, the compilation and publication of the price statistics is done by Nepal Rastra Bank (NRB), the Central Bank of Nepal. Additionally, the Wholesale Price Index (WPI) and Salary and Wage Rate Index are other significant indices produced by the Bank. Further, for the purpose of informed policy decisions, NRB also carries out the inflation expectation survey. NRB has initiated the evaluation of inflation expectations surveys, the first of which was conducted between January-February 2021, involving ten market centres across seven major cities, representing all provinces of Nepal. While all the price indices offer valuable insights, the CPI is generally recognised as the primary indicator of price levels and inflation trends within the Nepalese economy.

This study is broadly divided into two parts: the first focuses on the methodology and practices of inflation measurement in Nepal, while the second examines the factors driving inflation in the country. The analysis is based on measurement aspects of inflation analysing the determinants of group indices. This rationale behind the dissection of the overall price index is that it is the weighted sum of individual group indices.

1. The authors are Deputy Directors, Economic Research Department, Nepal Rastra Bank.

2. CPI Measurement in Nepal

The methodology for constructing Nepal's CPI begins with deriving expenditure weights from household budget surveys, which reflect consumption patterns across the population. These weights are revised approximately every decade to ensure accuracy, with the most recent update based on the 2022/23 Nepal Living Standards Survey. Data is gathered from diverse outlets by trained price collectors, following a standardised schedule and procedures to ensure consistency and representativeness. Collected price data undergoes rigorous quality control, including mutual verification by enumerators, centralised scrutiny, and physical monitoring visits to market centres. The CPI calculation employs a fixed-basket approach, aggregating elementary price indices—calculated using Jevon's formula—into higher-level indices using a weighted Laspeyres method. The national CPI is then compiled by aggregating indices from market centres to provincial and national levels, providing a comprehensive measure of inflation trends across Nepal. CPI measurements in Nepal uses the following methodology. The methodology has been gradually modified and updated for better representation of price movements in Nepal.

2.1 Source of Weight

A consumer price index is usually calculated as a weighted average of the relative price changes of the goods and services covered by the index (CPI Manual 2020). The weights used in CPI represent the proportions of consumption expenditure by households in a specified period and show the relative importance of goods and services in the CPI basket. It also influences changes in the overall index. Thus, the accuracy and the reliability of CPI estimates depend on the quality of the weights used.

In case of Nepal, the Household budget survey was the primary data source for deriving expenditure shares of goods and services listed in the CPI basket. So far, Nepal has conducted five household budget surveys. If weights are kept fixed over a long period of time, the index does not reflect the true pattern of consumption, which changes due to the factors such as change in income, demographic factors, etc. The bias in a fixed-basket index is likely to increase with the age of the weights. Considering such factors, the expenditures weights have been revised in Nepal based on the survey at the interval of at least 10 years. However, recently NRB has rebased the CPI considering FY 2023-24 as the new base year. For the first time, the weights for the new CPI series were derived from the results of the fourth Nepal Living standard survey. The survey contains detailed information on household expenditure and consumption of food and beverages, and non-food and services from a nationally representative sample of 9,600 households across 15 analytical domains or strata (seven provinces with rural and urban areas and Kathmandu valley). Household consumption is estimated as: i) sum of expenditure by households on goods and services for consumption, ii) value of goods produced at home (excluding services), and iii) goods received in kind and consumed by the households. Own-produced goods and received in kind are included in household consumption with imputed value at prevailing market prices (Technical note, NRB, 2016). House rent includes both actual rents and imputed rents. For owner-occupied houses, when the amount for estimated rent is not reported, the hedonic regression method is applied to impute rent.

The consumption expenditures are aggregated using a multi-stage stratified sampling methodology. Weights are distributed geographically based on average consumption expenditure and the number of households in each domain. Explicit weights are assigned for 249 goods and services mentioned in the NLSS IV questionnaire. For the remaining items grouped under 'other' or 'group' categories, implicit weights are assigned by the number of price quotations based on the retail survey on sales of those items.

Table 1: Summary of Various Surveys in Nepal

S.N.	Survey	Period	Coverage	Number of Market centers	Sample Households	Total Population	Number of Households
1	First HBS	1973/74	Rural and Urban	18	6,625	11,555,983	2,084,062
2	Second HBS	1984/85	Rural and Urban	35	5,323	15,022,839	2,584,948
3	Third HBS	1995/96	Urban	21	2,500	18,491,097	3,328,721
4	Fourth HBS	2005/06	Rural and Urban	48	5,095	23,151,423	4,253,220
5	Fifth HBS	2014/15	Rural and Urban	84	8,028	26,494,504	5,427,302
6	Nepal Living Standard Survey	2022/23	Rural and Urban	800 (PSU)	9600	29,164,578	6,666,937

2.2 CPI Basket

The CPI is calculated using a fixed-weight basket method. The list of items in the CPI basket are finalised using a cut-off sampling method that captures 97% of the total consumption of households and it covers at least 95% of consumption expenditure in each domain. Prices of items included in commodity basket are collected on weekly, monthly, and quarterly basis depending upon the perishability and the likelihood of changes in the prices of items. However, the quarterly items are further divided into three groups, and their prices are collected monthly on a rotation basis. Altogether, 249 commodities with 525 items are included in the basket.

Table 2: Collection Frequency, Items and Weight

S.N.	Frequency	Number of commodities	Number of Items	Weight
1	Weekly	37	59	11.17
2	Monthly	60	94	28.90
3	Quarterly	152	372	59.93
Total		**249**	**525**	**100**

2.3 Major Groups and Subgroups

The national level CPI index will be published under two broad groups: Food and Beverage and Non-Food and Services with 10 and 13 sub-groups, respectively. Alcoholic drinks, tobacco products, and restaurant and hotel groups have been placed in the non-food and services group, which were previously under the food and beverage group. Annex 1 shows the weights of major groups and sub-groups of the current and previous CPI. The weight of food and beverages group has slightly increased to 45.79 if we include the three sub-groups that were under food and beverage group earlier.

2.4 Frequency of Price Collection

The frequency of price collection are determined based on various factors such as volatility of prices, known regularity in price changes and other factors. In addition, price collection frequency differs according to the nature of goods and services. Out of the 525 goods and services in the CPI basket, prices of 59 commodities are collected on a weekly basis; prices of 94 goods and services are collected on a monthly basis whereas prices of 372 goods and services are collected on a quarterly basis. The assigned weights for weekly, monthly and quarterly goods and services are 11.17%, 28.90% and 59.93% respectively.

2.5 Selection of Market Centres

The market centres are selected based on the population distribution as given by the Population Census 2021 and the number of industry establishments as given by the National Economic Census 2018 conducted by the National Statistics Office (NSO). A total of 87 market centres covering all 77 districts are selected. Among these, 21 represent rural markets while 66 represent urban markets. This selection ensures representation from each of the seven provinces, with three rural markets per province chosen based on population and establishment data.

Table 3: Number of Market Centres

S.N.	Province#	Rural	Urban	Total
1	Koshi	3	12	15
2	Madhesh	3	9	12
3	Bagmati	3	8	11
4	Gandaki	3	8	11
5	Lumbini	3	10	13
6	Karnali	3	7	10
7	Sudur Paschim	3	7	10
8	Kathmandu Valley	-	5	5
	Total	**21**	**66**	**87**

There are seven provinces in Nepal, here Kathmandu valley is a part of Bagmati province.

2.6 Selection of Outlets

While selecting outlets for inclusion in the CPI sample, the entire area of each of the selected market is initially divided into three major sub-areas. The sub-areas are delineated to ensure geographical diversity. Three outlets are then selected from each of the sub-area, prioritising those where the majority of households make their purchases.

The price collectors gather price data for each commodity on the list and also rate the outlet across various criteria such as reliability, helpfulness, sustainability, availability of commodities, etc. Outlets with higher ratings are selected from each area ensuring three outlets for most items. The number of quotations are maintained less than three for items with less weightages and number of outlets too.

2.7 Price Collection Procedure

Price data is collected regularly from designated market centres on a weekly, monthly and quarterly basis. The price collection procedure is field-based for most of the items. A centralised price collection mechanism has been implemented for 28 items such as data packages, phone calls, laptops, airfare in the current system. NRB employs teachers from public schools across the nation for price collection purposes. The teachers are selected on the basis of 'Guidelines for selection of school and price collector'. They visit sampling outlets of the respective market centres at the pre-determined time to obtain actual retail prices. The price quotes are collected on a weekly, monthly and quarterly basis. Price collectors must visit the outlet as all price quotes are based on field collection from the retailers. The Price Division sets the fixed schedule for price collectors for outlet visits as follows.

Table 4: Field Visit Frequency for Data Collection

Data Frequency	Field Visit Time
Weekly	Saturday morning of each week
Monthly	Two days before month end
Quarterly	Four days before quarter end

2.8 Price Submission Procedure

A price collector submits collected quotations via web application of the CPI developed by the Price Division. Another price collector is required to review the data and verify them. If price changes occur by more than a certain percentage than the previous period, collectors must enter a message explaining the reasons.

2.9 Treatment for the Missing Prices

The group mean imputation method is used for seasonal and temporarily missing data. The review mechanism has been developed to regularly monitor market activities and address issues such as emergence of new products and disappearance of existing items.

2.10 Data Quality Control Mechanism

Data quality management is an important aspect for true representation of the general price level as the accuracy and reliability of price quotes are very important. The Price Division of the NRB ensures data quality through various methods:

1. Firstly, within each market centre, a system of mutual verification is employed. Each price collector must verify the quotes collected by his/her colleague minimising the potential for individual error. Enumerators act as data collectors and verifiers on an alternative basis.

2. Secondly, after submission of data to the Division through dedicated web application, the Price Division scrutinises the price data. This validation phase ensures that prices are not contradictory and falls within the acceptable ranges.

3. Besides the abovementioned provisions, the Price Division implements additional initiatives to maintain data accuracy. Periodically, designated staff members conduct physical price monitoring visits to outlets within designated market centres.

4. Furthermore, the Division promotes understanding among stakeholders through orientation programmes, educating outlet owners on the significance of reliable price statistics. Further, the Division has initiated virtual data validation meetings. During these sessions, outlet owners are contacted directly, via telephone to confirm the reported price quotes, ensuring consistency and transparency.

5. Capacity development and awareness training programmes for enumerators are conducted regularly.

2.11 Calculation of Index

Nepal's CPI calculation methodology follows a fixed-basket approach. It measures the changes in price of a basket of fixed composition in terms of quantity and quality, as far as possible. CPIs are typically calculated in two steps. In the first step, the elementary price indices for each of the elementary aggregates are calculated. In the second step, higher-level indices are calculated by taking weighted averages of the elementary price indices. (CPI, Manual)

(i) Elementary Level Aggregation

The lowest-level aggregates are also called elementary aggregates. Elementary aggregates form the building blocks for the compilation of the consumer price index. The detailed weights are not available at the lowest level of aggregation. Thus, elementary aggregates combine prices into indices treating all the products as equally important. (2019, ONS).

Generally, the price of each item from various outlets of each market centre is taken, after which the **Elementary Price Index** at the current period is subsequently calculated using Jevon's formula.

$$_{(i,a)}\mathrm{I}^{\mathrm{J}}{}_{[t;0]} = \prod_{j\epsilon(i,a)}\left(\frac{P_{j,t}}{P_{j,0}}\right)^{1/n}$$

Where, n = number of price quotation of items.

$_{(i,a)}\mathrm{I}_{[t;0]}$ = Geometric mean of price relatives for the item-area combination (i, a) from the base period 0 to the current period t;

$P_{j,t}$ = the price of item j, a member of item stratum i, observed in area a at time t;

$P_{j,0}$ = the price of the same item j in base period 0, which is fiscal year 2023-24.

(ii) Upper Level Aggregation

Elementary price indices are aggregated by using weights to derive the national consumer price index. The CPI is a weighted aggregation of un-weighted elementary indices. Higher level index is calculated by using a modified Laspeyres formula which can be written in the following algebraic expression,

$$I_{0,t} = \left[\sum_{j} I^{J} \times W_j\right]$$

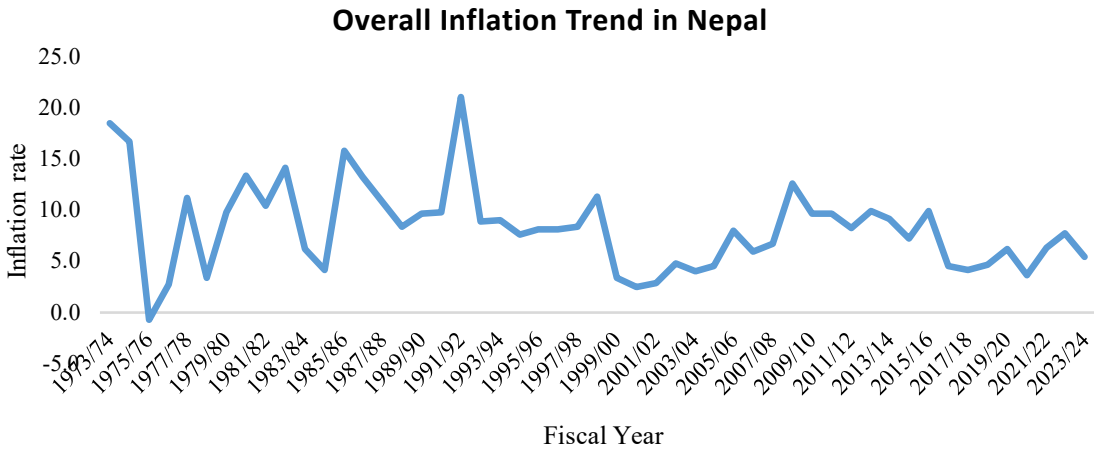
Where, $W_j = \frac{w_j}{\sum_j w_j}$ is the expenditure shares for the individual items in the reference period.

Monthly indices are calculated independently for each market centre and then aggregated to the provincial and national level for sub-groups, groups, and an overall general index.

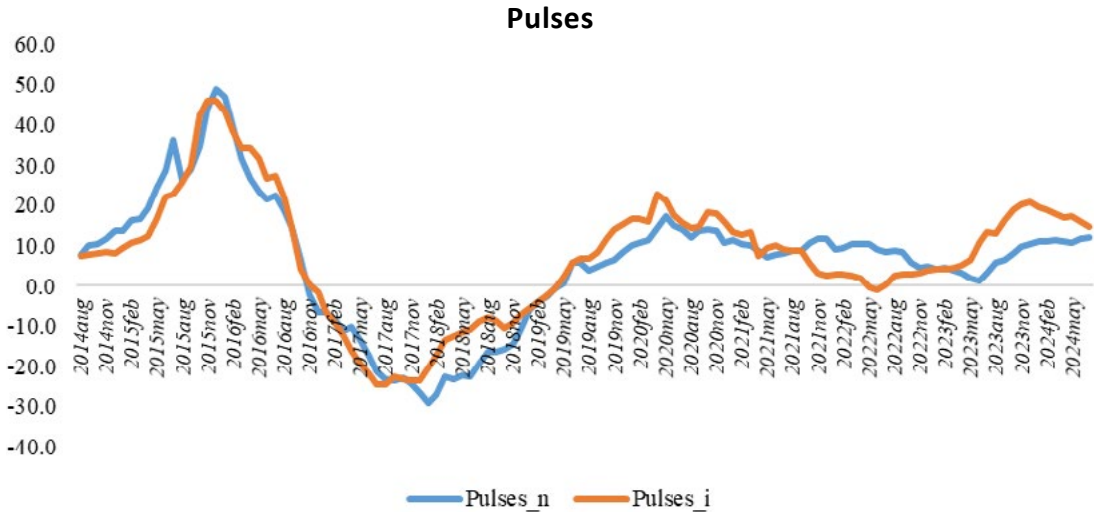
3. Inflation Dynamics and Monetary Policy in Nepal

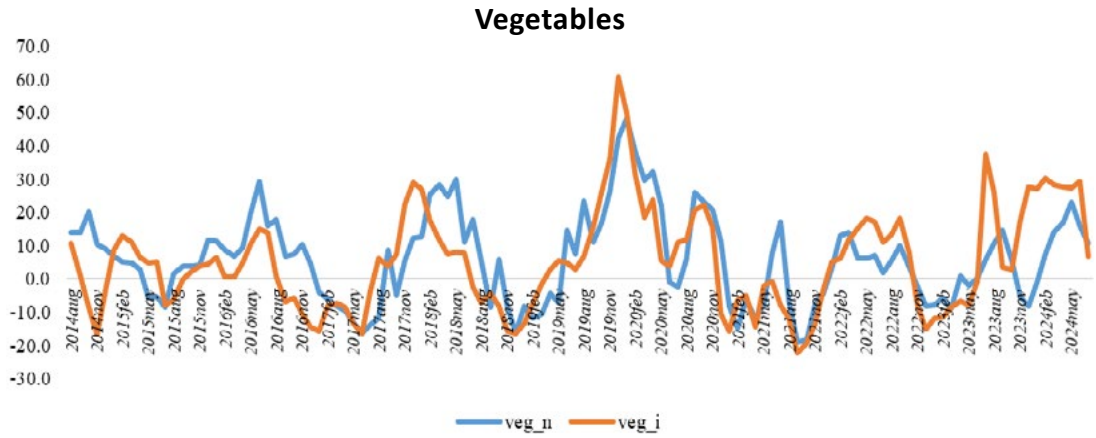
3.1 Inflation Trend in Nepal

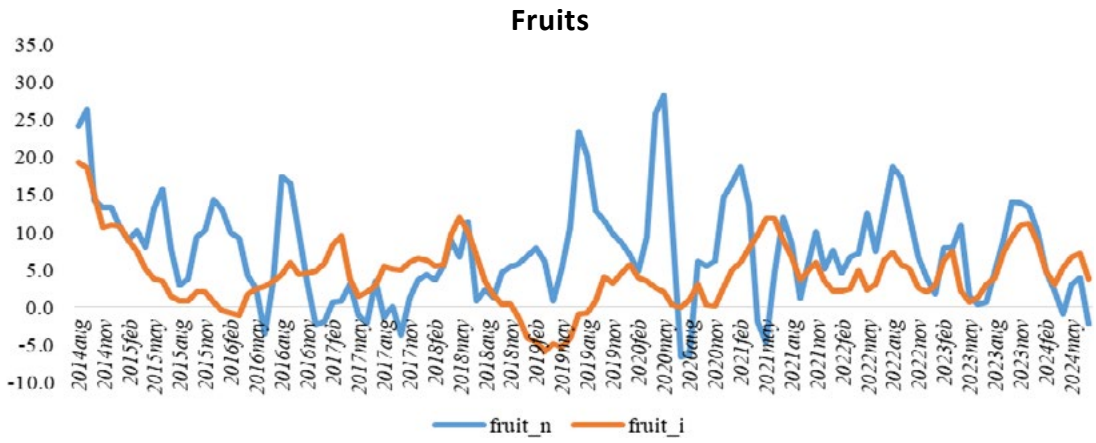
During the last fifty-one years, the average annual inflation rate of Nepal was 8.3%. Nepal witnessed the highest inflation of 21.05% in 1991/92 and underwent disinflation of 0.69% in 1975/76. The average annual inflation rate seems to be lower in later years.

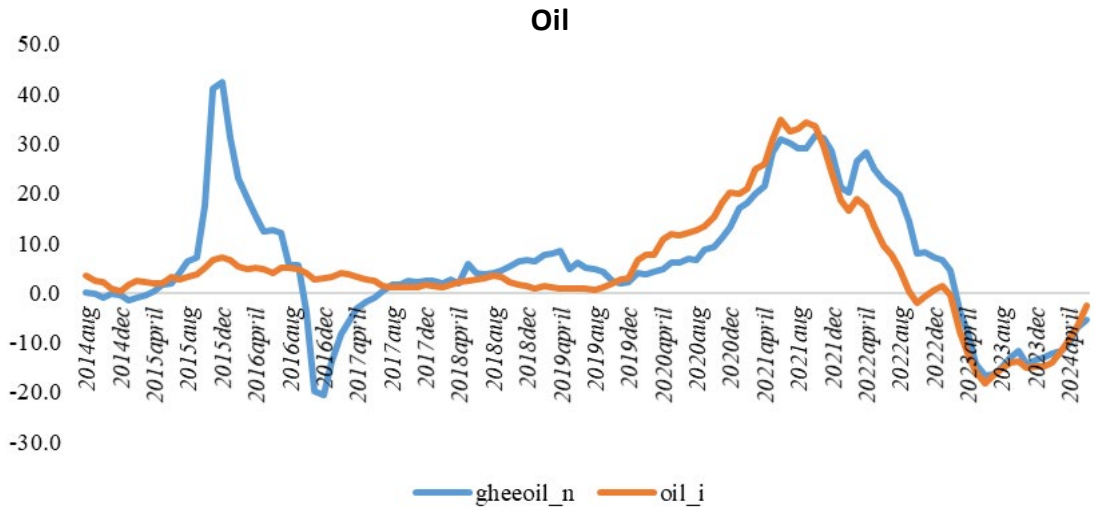


When decomposing overall inflation into its food and non-food components, non-food inflation has exhibited a greater contribution in most of the fiscal years. This trend can be attributed to several factors, including the higher weightage of non-food categories in the consumer price index, fluctuations in exchange rates, increased demand for non-food items, inefficient distribution channels, and rising living costs such as fuel, rent, and education expenses.



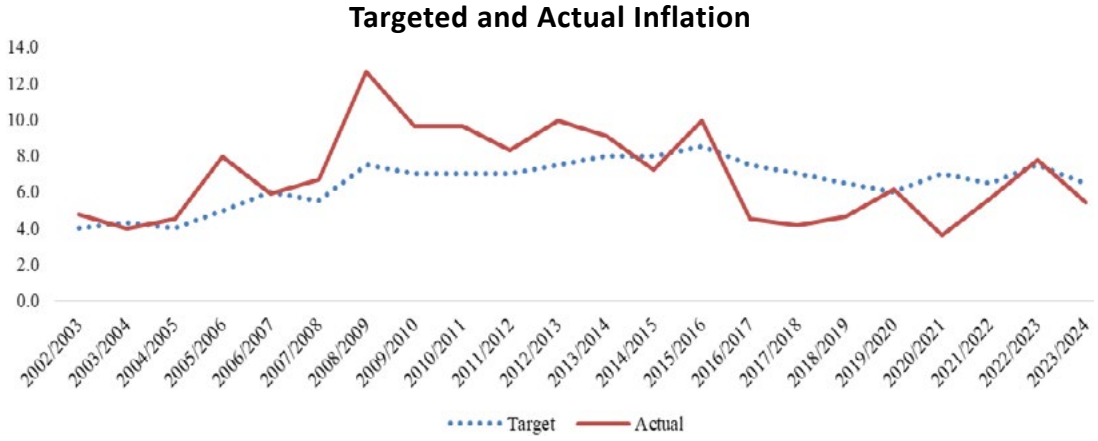






3.2 Price Movement Analysis

The previous researches have shown that the inflation in Nepal is mainly influenced by the inflation of India. The study of Mathema (1998), NRB (2007), Shrestha and Bhatta (2018) and IMF (2019) empirically support the premise that the price movement in Nepal is influenced by the price movement of India. Further, the pegged exchange rate regime and large volume of Nepal's trade of more than two-thirds with India, reinforces the findings.



Ginting (2007) suggests a limited role for long-term monetary policy in Nepal due to its dependence on Indian inflation dynamics. Furthermore, quantitative analyses by Anand and Cashin (2016) reveal a substantial "pass-through" effect, indicating that a 1% rise in Indian inflation translates to a 0.45% increase in Nepal's inflation. This spillover effect is primarily concentrated within the food sector, as highlighted by the International Monetary Fund (IMF, 2019). The study finds minimal evidence for significant spillover of non-food inflation from India to Nepal, suggesting a closer relationship within different product categories. Bordo (1980) evaluates the traditional view of supply and demand dictating commodity price changes uniformly after monetary shifts. Instead, it proposes price flexibility as a key factor, influenced by contract length. Prices with longer contracts adjust slower, similar to how long-term wages behave. US data support this "sticky price" explanation, alongside the traditional view's predictions. Therefore, policymakers should consider contract lengths when analysing commodity price reactions to monetary changes.

While conducting a granular analysis of sub-group movements within the food inflation category, the initial result reveals different dynamics. The preliminary observations suggest a lack of complete co-movement across all sub-groups.

The empirical investigation highlights statistically significant correlations between specific sub-groups, such as pulses & legumes and vegetables & fruits, in both countries. Such linkages demonstrably influence headline inflation in Nepal. Therefore, policymakers in Nepal should prioritise close monitoring of price movements within these specific sub-groups to design effective policy.

3.3 Inflation and Monetary Policy in Nepal

NRB initiated the practice of disclosing its monetary policy publicly from FY 2002/03, incorporating targeted inflation rate as a key component. The main aim was to enhance transparency and accountability in monetary policy implementation.

A pegged exchange rate with India, coupled with the control of capital outflow, would mean that the role of monetary policy is obviously limited. The effectiveness of monetary policy in Nepal is an interplay of various factors. During the last 22 years, the actual inflation rate deviated significantly from the targeted rate in 13 occasions. For remaining years, the actual inflation remained below the target.

Inflation, Credit Growth and Lending Rate

Private sector credit growth in Nepal has exhibited a robust trajectory over the years. This trend was further amplified during the post-COVID period with resumption of economic activity. The average private sector credit growth rate from 2002-03 to 2021-22 remained at 19.7%. The rapid credit expansion along with other factors has been identified as a key driver of inflationary pressure. To mitigate this, NRB implemented monetary tightening measures in 2022-23, which curtailed the credit growth rate to a single digit level. However, a notable decline in the average lending rates has not been observed, raising concerns about the transmission mechanism of monetary policy.

3.4 The Model

There are numerous studies in Nepal which explore the factors driving inflation, relying on various inflation theories. Neupane (1992) finds significant effects of narrow money (M1) and change in expected cost of holding money on inflation, while structural factors like import price inflation and budget deficit have limited impact. The Institute for Sustainable Development (ISD) (1994) using a simple linear regression show that Indian wholesale price index (WPI) had a stronger impact (0.8) on inflation than money supply growth, although the explanatory power improved when narrow money plus savings deposits were included.

Mathema (1998) using annual data finds a significant impact of narrow money supply, import prices, and wages on inflation, with the influence of Indian WPI being non-significant but slightly altering the coefficients of other variables. NRB (2001) utilises PDL models on quarterly data and identifies that money supply impacts prices up to three quarters, with narrow money (M1) having a stronger influence (0.45) compared to broad

money (M2). Khatiwada (2005) analyse the post-liberalisation determinants of inflation, where the role of money in explaining inflation declined, while exchange rate effects strengthened; narrow money was deemed more effective than broad money for policy purposes.

NRB (2007) using cointegration and error correction models to examine determinants of inflation, reveal a significant short-run effect of narrow money and Indian inflation on Nepal's inflation, with a stronger influence of Indian price levels (1.09) compared to M1 (0.20). IMF's (2011) analysis indicates that broad money significantly affects non-food inflation but only in the short-term, while external variables like Indian inflation and oil prices have a growing influence. The IMF (2014) study estimates that a 1% increase in broad money raises inflation by 0.12%, whereas a similar increase in Indian CPI raises it by 0.45%, highlighting the dominance of external factors in determining inflation in Nepal. Shrestha and Bhatta (2018) using monthly data, find that money supply significantly influences domestic prices while Indian inflation has the largest impact on Nepal's price levels, and the exchange rate has no significant association. They conclude that the money-price relationship in Nepal has strengthened in recent years in terms of its impact magnitude.

IMF (2019) shows that the considerable co-movement in headline inflation rates between India and Nepal is driven almost exclusively by food-inflation co-movement. However, the role for inflation spillovers emanating from India in driving non-food inflation in Nepal appears limited.[2] Further, as most studies provide valuable insights about inflation in Nepal, they are imperative for an informed policy formulation process. Addressing any gaps is crucial for developing a comprehensive understanding of inflation in Nepal and crafting informed policy responses.

Most of the research on determinants of inflation in Nepal employ annual data. The trends of non-food inflation show that the inflation spillovers from India to non-food inflation in Nepal have a minimal impact, highlighting the importance of identifying domestic factors that drive inflation in Nepal.

The exchange rate of the Nepalese currency is pegged with the Indian currency, i.e., Nepal has a fixed exchange rate regime with India. There is a high concentration of merchandise trade between Nepal and India. In the Fiscal Year 2023/24, the share of total exports to India remained at 67.7% while the share of imports was 62.6% of total international exports and imports, respectively. Moreover, Nepal has a low export base compared to imports. In the same fiscal year, the ratio of import to export remained tenfold, which signifies that import is the channel of price transmission from India to Nepal. The fixed exchange rate along with a high concentration of trade in India, infer that Nepal is a price-taker country.

2. IMF (2019) Nepal Selected Issues, IMF Country Report No. 19/61.

There are 21 sub-group indices in Nepalese CPI groups where 9 categories are summed up in the food and beverages group and the remaining 12 sub-groups summed up in the non-food and services group which are available from mid-August 2014 to July 2024. We use the following econometric equation for the group indices and identify which are mostly influenced by the external sector or domestic monetary policy and exogenous shock.

$$P_{i,t} - P_{i,t-k} = \propto_{i,t} + \beta_{it}(M2_t - M2_{t-k}) + \beta_t E_{t-k} + \gamma_{it}(PInd_{it} - PInd_{it-k}) + \boldsymbol{\lambda_{it}} \boldsymbol{X}_{it-k} + \in_{it}$$

Where $P_{i,t}$ is the log price level for group i in quarter t, the i is either overall price index food and beverages or overall index of non-food and services.

Further, the variable $M2_t$ is the broad money supply measured as monetary policy shock in quarter t, $FPIND_{i,t}$ is the log food price index of India, E_{t-k} is the exchange rate of Nepalese currency in terms of US dollar at time t-k where k is either previous quarter or same quarter of the previous year and $\boldsymbol{X_{it}}$ is a vector which controls the other relevant variables which affect the prices of the broader group of CPI, and $\in_{it}$ is error term which are not explained by the model. Prior to the empirical estimations, the variables are tested for stationarity, trend and summary of central tendency.

3.5 The Empirical Method and Results

The descriptive analysis comprises: (i) ascertaining the data variation during the period, (ii) testing the stationarity of the time series using Augmented Dickey Fuller (ADF) test, (iii) as per the prior information about the two big supply and demand shocks faced by the economy, dummy variables are created respectively to control the impact of shocks of 2015 earthquake and Covid-19. Further, two separate alternative regression models are run covering the given data set which are categorised into (i) regression using the difference between two consecutive quarters, and (ii) the year-on-year differences which is a difference of data of a given quarter with a year before data of the same quarter. The benefits of fitting different alternative equations to represent price dynamics provide information about the variable that consistently affects the price movement of Nepal.

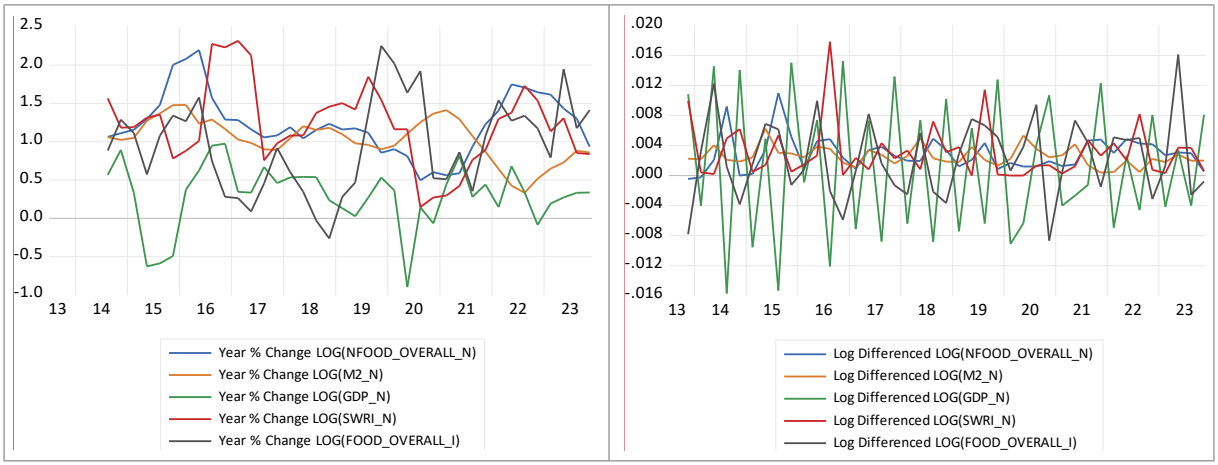
3.5.1 Descriptive Statistics

The study uses quarterly macroeconomic data sets from 2013 Q1 to 2024 Q4. This period covers price statistics which are computed based on base year FY 2013-14. The data, such as the exchange rate, broad money, salary and wage rate index are taken from the NRB's publication. In contrast, GDP is taken from the Nepal Statistics Office, Government of Nepal. The data of the Indian food price index is taken from the website of MOPSI (Ministry of Statistics and Programme Implementation, India), Government of India.

Table 5: Descriptive of the Properties of Variables (Sample: 2013Q3 2023Q4)

Variables		Summary Statistics							Unit Root Test (ADF)	
Name	Notation	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Proba-bility	Level	First Difference
FOOD PRICE INDEX	FOOD_OVERALL_N	4.81	4.77	0.17	-0.03	2.17	1.22	0.54	-0.133	-2.754**
NON-FOOD AND SERVICES PRICE INDEX	NFOOD_OVERALL_N	4.84	4.86	0.17	-0.09	1.98	1.87	0.39	-1.3192	-2.9794**
BROAD MONEY	M2_N	14.97	14.99	0.48	-0.14	1.76	2.84	0.24	-1.569	-2.905**
GROSS DOMESTIC PRODUCT	GDP_N	13.11	13.11	0.14	-0.40	2.41	1.72	0.42	-0.462	-3.5556*
SALARY AND WAGE RATE INDEX	SWRI_N	6.15	6.18	0.23	-0.17	1.81	2.69	0.26	-0.991	-8.0114*
FOOD PRICE INDEX INDIA	FOOD_OVERALL_I	4.99	4.94	0.14	0.32	2.09	2.19	0.33	0.931	-8.7826*
EXCHANGE RATE 1USD IN NPR	EXRATE_N	4.72	4.70	0.10	0.29	2.01	2.29	0.32	-0.270	-5.4725*
Statistical significance: * denotes p<1%, ** denotes, p<5% and *** denotes p<10%.										

Graphical Presentation of Variables



The variables have low skewness and kurtosis, suggesting near-normal distributions where broad money supply (M2_N) and Salary and Wage Rate Index (SWRI_N) show slightly lower kurtosis, indicating relatively flatter distributions. Further, the Jarque-Bera test probabilities indicate that none of the variables deviate significantly from normality. At the level, all variables have unit roots (non-stationary), as indicated by the ADF test results. With the first difference, all variables become stationary, confirming the

suitability of these variables for further econometric analyses using ordinary least squares with differencing, which can be further used in cointegration or Vector Auto Regression analysis. However, the data are used to identify the short-run implications of the model in inflation determination, focusing on how food and non-food groups are influenced by domestic and external variables. The stationarity of time series data is tested using the Augmented Dickey Fuller (ADF) test, which is presented in Table 5. The test statistics show that the series of all five variables have a unit root. At the first difference, log values of all the series are stationary.

3.5.2 Statistical Results

Food Price Component

Food inflation in Nepal is primarily driven by variables like Indian food inflation, exchange rate and GDP. Empirical results indicate that Indian food inflation exerts a significant impact on Nepal's food inflation.

Table 6 shows the growth rate (logarithmic difference) of the Food Price Index, indicating how the variable changes over time. The food price index coefficients in the models are 0.6086* (F2A), 0.6886* (F2B), and 0.6991* (F2C), which are positive and highly significant at the 1% level across all models. A 1% increase in India's Food Price Index growth rate is associated with a 0.61% to 0.70% increase in Nepal's Food Price Index growth rate, highlighting strong spillover effects from India's food prices.

The coefficient of broad money is 0.3074, significant at the 10% level in F2A, but becomes insignificant in other models. Money supply growth has a positive but weaker impact on food price growth, with diminishing effects across models. The negative coefficient of -0.1288* in F2A, significant at the 1% level, indicates that economic growth reduces food price growth, possibly due to improved productivity or structural adjustments in the economy. Changes in the exchange rate have a negligible effect on food price growth in this specification.

R-squared values range from 0.42 to 0.65, indicating that the explanatory variables account for 42% to 65% of the variation in the dependent variable. F2A explains the most variation (R-squared: 0.6547), while F2B and F2C are less explanatory. High F-statistic and p-values indicate all models are statistically significant, while relatively lower values represent better model fit; F2A performs best. The DW values, which are more than 2, indicate that the model can be used cautiously as there is no significant autocorrelation in residuals. The model F2A explains the most variability, has the lowest standard error, and includes significant predictors. It shows that both external (India's Food Price Index) and internal (money supply and GDP growth) factors influence Nepal's food prices.

Policies addressing domestic money supply and leveraging the impact of economic growth could help stabilise food prices. Strong dependency on India's food prices suggests the need for coordinated efforts or hedging against external price shocks. The

model F2C additionally shows that the exchange rate has little significance, which may indicate its minimal direct impact on food prices.

Table 6. Dependent Variable: DLOG(FOOD_OVERALL_N)
Sample (adjusted): 2013Q4 2023Q4

Variable	Models		
	F2A	F2B	F2C
Constant	-0.0034	-0.0034	0.0864
	Coefficients		
DLOG(FOOD_OVERALL_I)	0.6086*	0.6886*	0.6991*
DLOG(M2_N)	0.3074***	0.2382	0.2126
DLOG(GDP_N)	-0.1288*		
LOG(EXRATE_N)			-0.0188
	Test Statistics		
R-squared	0.6547	0.4196	0.4227
Adjusted R-squared	0.6267	0.3890	0.3758
S.E. of regression	0.0192	0.0246	0.0249
F-statistic	23.3865	13.7332	9.0288
Prob(F-statistic)	0.0000	0.0000	0.0001
Akaike info criterion	-4.9710	-4.5003	-4.4569
Schwarz criterion	-4.8038	-4.3749	-4.2897
Durbin-Watson stat	2.4240	2.8786	2.9015

Statistical significance: * denotes p<1%, ** denotes, p<5% and *** denotes p<10%.

Table 7 presents four econometric models (F1A, F1B, F1C, and F1D) analysing the determinants of Nepal's annual food price growth, represented as the log difference of the food price index over four-quarter lags. India's annual food price growth coefficient is positively and highly significant in all models, with coefficients ranging from 0.8264 to 0.8648, indicating that a percentage increase in India's annual food price growth leads to an 0.83% to 0.86% increase in Nepal's annual food price growth. India's food price trends strongly influence Nepal's food prices, likely due to economic interdependence and trade ties. The comparison of the models show that there is a weak influence of money supply in food prices, a 1% annual growth in money supply corresponds to a 0.18% to 0.22% increase in food price growth, indicating that monetary policy plays a moderate role in price stability. F1D is the best model for explaining Nepal's annual food price growth, as it incorporates all relevant factors (India's food prices, money supply, exchange rate) and achieves the highest R^2. Thus, policymakers should focus mainly on external price spillovers along with monetary policy, and exchange rate stability to manage food price inflation effectively.

Table 7. Dependent Variable: LOG(FOOD_OVERALL_N/FOOD_OVERALL_N(-4))
Sample (adjusted): 2014Q3 2023Q4

	Models			
Variable	F1A	F1B	F1C	F1D
Constant	-0.0116	-0.0003	-0.0116	-0.0186
	Coefficients			
LOG(FOOD_OVERALL_I/ FOOD_OVERALL_I(-4))	0.8648*	0.8456*	0.8648*	0.8264*
LOG(M2_N/M2_N(-4))	0.2059***	0.1755	0.2059***	0.2222**
LOG(GDP_N/GDP_N(-4))		-0.1321***		
LOG(EXRATE_N/EXRATE_N(-4))				0.1964**
DUM_COVID_1	-0.0177	-0.0216***	-0.0177	-0.0168
	Test Statistics			
R-squared	0.4923	0.5373	0.4923	0.5605
Adjusted R-squared	0.4475	0.4812	0.4475	0.5072
F-statistic	10.9904*	9.5807*	10.9904*	10.5203*
Durbin-Watson stat	1.0526	1.1091	1.0526	1.1944

Statistical significance: * denotes p<1%, ** denotes, p<5% and *** denotes p<10%.

India's Food Price Index is the most consistent and significant determinant across all models. Money supply moderately influences although its significance varies, depending on the inclusion of other variables. The GDP growth acts as a stabilising force, reducing food prices when included in the inflation models. COVID-19 has a small and temporary effect on food prices during the pandemic.

Non-food and Services Component

Table 8 examines the determinants of non-food price inflation in Nepal using five different models where the dependent variable is the log difference of the Non-food Price Index of Nepal. Money supply shows a positive but insignificant effect in Non-food and services price index, suggesting that money supply changes of the previous quarter are not robust determinants of non-food price changes of current quarter.

Money Supply Growth suggests there is mixed and weak evidence for a link between money supply and non-food prices. The current GDP Growth and lagged GDP growth show a negative but limited influence of economic growth on non-food inflation. However, the food price growth shows a significant and positive 0.2043 coefficient in model **NF2B,** indicating that a 1% rise in food price growth leads to a 0.20% increase in non-food price growth, reflecting interlinkages between food and non-food prices.

Table 8. Dependent Variable: DLOG(NFOOD_OVERALL_N)
Sample (adjusted): 2014Q3 2023Q4

	Models					
Variables	**NF2A**	**NF2B**	**NF2C**	**NF2D**	**NF2E**	**NF2F**
Constant	0.0127*	0.0144*	0.0108*	0.0117*	0.0117*	0.0127*
	Coefficients					
DLOG(M2_N)	0.0123	-0.1353	0.0052			0.0123
DLOG(GDP_N)	-0.0151	0.0086				-0.0151
DLOG(GDP_N(-1))				-0.0069		
DLOG(FOOD_OVERALL_N)		0.2043*				
DLOG(SWRI_N)	0.1496***	0.0993	0.1582**	0.1685*	0.1595*	0.1496***
DUM_COVID_1	-0.0059			-0.0048	-0.0046	-0.0059
DUM_EARTHQUAKE				0.0345*	0.0343*	
	Test Statistics					
R-squared	0.2179	0.3441	0.1030	0.4713	0.4654	0.2179
Adjusted R-squared	0.1231	0.2712	0.0558	0.4072	0.4183	0.1231
Akaike info criterion	-6.2685	-6.4176	-6.2021	-6.6600	-6.7016	-6.2685
Schwarz criterion	-6.0530	-6.2086	-6.0767	-6.4445	-6.5293	-6.0530
Hannan-Quinn criterion	-6.1918	-6.3415	-6.1565	-6.5833	-6.6403	-6.1918
Durbin-Watson stat	1.8333	1.6509	1.6190	2.0210	2.0522	1.8333

Statistical significance: * denotes p<1%, ** denotes, p<5% and *** denotes p<10%.

Salary and Wage Rate Growth remains positive and is consistently significant in all models, with coefficients ranging from 0.0993 to 0.1685. It highlights the crucial role of salary and wages in driving non-food price inflation, as wage increases directly raise production and service costs of non-food items. COVID-19 is negative but insignificant in all models, suggesting no significant impact of the pandemic on non-food price inflation. However, the positive and highly significant NF2D and NF2E, indicate that the 2015 earthquake caused a noticeable inflationary impact on non-food prices, likely due to supply chain disruptions and increased demand for reconstruction-related services. However, NF2D and NF2E show minimal autocorrelation in residuals for the lower values in other models (e.g., NF2B and NF2C), suggesting possible autocorrelation issues. The salary and wage growth shows it is a consistent and significant driver of non-food inflation across all models while the 2015 earthquake demonstrates significant inflationary effects as evident in NF2D and NF2E.

Table 9. Dependent Variable: LOG(NFOOD_OVERALL_N/NFOOD_OVERALL_N(-4))
Sample (adjusted): 2014Q3 2023Q4

Variables	Models					
Model	NF1A	NF1B	NF1C	NF1D	NF1E	NF1F
Constant	0.046*	0.023*	0.0679*	0.0641*	0.0891*	0.0845*
	Coefficients					
LOG(M2_N/M2_N(-4))			-0.1073	-0.0971	-0.1615**	-0.1493**
LOG(SWRI_N/SWRI_N(-4))	0.2141**	0.2808*	0.1800***	0.1676***		
LOG(GDP_N/GDP_N(-4))			-0.0713		-0.0616	
LOG(FOOD_OVERALL_N/ FOOD_OVERALL_N(-4))		0.3164*				
DUM_EARTHQUAKE	0.0054	-0.0069				
DUM_COVID_1	-0.0184	-0.0237*	-0.0209*	-0.0184**	-0.0203*	-0.0182**
	Test Statistics					
R-squared	0.2626	0.5282	0.3340	0.2952	0.2580	0.2287
Adjusted R-squared	0.1976	0.4710	0.2533	0.2330	0.1925	0.1846
F-statistic	4.0363	9.2348	4.1377	4.7472	3.9404	5.1884
Prob(F-statistic)	0.0147	0.0000	0.0080	0.0072	0.0163	0.0106
Akaike info criterion	-5.2368	-5.6307	-5.2860	-5.2820	-5.2306	-5.2445
Schwarz criterion	-5.0644	-5.4152	-5.0706	-5.1096	-5.0582	-5.1152
Durbin-Watson stat	0.6018	0.8069	0.6343	0.5213	0.3969	0.3738

Statistical significance: * denotes p<1%, ** denotes, p<5% and *** denotes p<10%.

Table 9 examines the long-term dynamics of Nepal's non-food price inflation, expressed as the year-on-year log difference of the time series over the period 2014Q3–2023Q4 across the six models. In the year-on-year model, money supply growth is an insignificant coefficient in NF1A and NF1B but is negative and significant in NF1E and NF1F at the 5% level of significance. A 1% year-on-year rise in money supply growth reduces non-food price inflation by 0.16% (NF1E) and 0.15% (NF1F), suggesting that tight monetary policy can have influence within a period of a year. The salary and wage rate growth show a positive and consistently significant trend in the models NF1A, NF1B, and NF1C, as a 1% rise in salary and wage growth raises non-food price inflation by 0.28 percentage points (NF1B) and 0.21 percentage points (NF1A). This highlights that salary and wage rates are key cost-push drivers in the non-food and service sector. The evidence for GDP growth influencing long-term non-food price inflation is weak.

The inclusion of the food price index shows positive and significant results in NF1B, with a coefficient of 0.3164. It indicates a strong spillover effect of food price inflation on non-food prices. The earthquake dummy has a limited long-run effect on non-food prices. The COVID-19 dummy is negative and significant in most models, including NF1B, NF1C, NF1E, and NF1F. It reflects the deflationary pressure during the pandemic, possibly due to reduced demand and supply chain disruptions.

4. Conclusion

This paper highlights the critical role of Indian food inflation in shaping Nepal's overall price dynamics, emphasising the strong spillover effects stemming from Nepal's trade and import dependency on India. The key food sub-groups such as pulses, legumes, vegetables, and fruits exhibit a similar trend of price movements between the two countries, reinforcing the need for Nepalese policymakers to closely monitor these sub-groups. On the other hand, non-food inflation in Nepal is primarily influenced by domestic factors like wage growth and external shocks, including natural disasters and the COVID-19 pandemic. However, the changes in monetary supply show mixed effects, with limited short-term significance. They exhibit deflationary impacts in the long-run on non-food prices.

Nepal's Consumer Price Index (CPI) is constructed using expenditure weights derived from household budget surveys, updated approximately every decade, with the latest based on the 2022/23 Nepal Living Standards Survey. Price data is collected from diverse outlets by trained collectors following standardised procedures and undergoes rigorous quality control to ensure accuracy. The CPI employs a fixed-basket approach, using Jevon's formula for elementary indices and a weighted Laspeyres method for aggregation, providing a comprehensive measure of inflation trends from provincial to national levels.

The findings stress the need for a dual-pronged approach to inflation management in Nepal. Policymakers must balance monetary policy to control inflation without stifling economic growth while addressing structural issues in the food and non-food sectors. Proactive interventions through supply management during the periods of rising Indian food prices can help stabilise Nepal's food inflation, while strategies to manage wage growth and timely address of natural shocks are essential for controlling non-food inflation. Moreover, a comprehensive framework that addresses both demand- and supply-side factors, ensuring long-term price stability and economic resilience, and which can tackle inflationary pressures during crises such as pandemics and earthquakes, is vital.

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Annex I: Various Groups and Weights in CPI Basket

S.N.	Particulars	Weights	
		2014/15 (100)	2023/24 (100)
1	**Food and Beverages**	**39.90**	**35.49**
1.1	Cereal grains and their products	11.33	8.08
1.2	Pulses and Legumes	1.84	1.76
1.3	Vegetable	5.52	4.65
1.4	Meat and Fish	6.75	6.76
1.5	Milk products and Eggs	5.24	4.28
1.6	Ghee and Oil	2.95	2.97
1.7	Fruit	2.08	3.23
1.8	Sugar and Sugar products	1.74	1.10
1.9	Spices	1.21	1.80
1.10	Non-alcoholic drinks	1.24	0.87
	Alcoholic drinks	*	*
	Tobacco products	**	**
	Restaurant and Hotel	***	***
2	**Non-food and services**	**60.10**	**64.51**
2.1	Alcoholic drinks	0.68	1.26
2.2	Tobacco products	0.41	1.03
2.3	Clothing and footwear	7.19	5.65
2.4	Housing and utilities	20.30	16.66
2.5	Furnishing and Household equipment	4.30	5.91
2.6	Health	3.47	5.51
2.7	Transport	5.34	6.26
2.8	Communication	2.82	3.60
2.9	Recreation and culture	2.46	1.52
2.10	Education	7.41	4.67
2.11	Restaurant and Accommodation Services***	2.92	8.00
2.12	Insurance and Financial Services	***	0.93
2.13	Miscellaneous goods and services	2.81	3.49
	Total (1+2)	**100.00**	**100.00**

Annex II: Variables in Log Levels

	FOOD INDEX	NON-FOOD INDEX	M2	GDP	SWRI	FOOD INDEX INDIA	EXRATE NEPAL	DUMMY EARTHQUAKE	DUMMY COVID_19
2013Q3	4.52	4.55	14.14	12.79	5.74	4.79	4.59	0	0
2013Q4	4.49	4.55	14.18	12.93	5.80	4.75	4.60	0	0
2014Q1	4.52	4.55	14.21	12.88	5.80	4.77	4.57	0	0
2014Q2	4.55	4.56	14.26	13.07	5.80	4.83	4.56	0	0
2014Q3	4.62	4.60	14.29	12.87	5.83	4.83	4.59	0	0
2014Q4	4.58	4.60	14.32	13.05	5.87	4.81	4.62	0	0
2015Q1	4.60	4.60	14.36	12.93	5.87	4.82	4.60	0	0
2015Q2	4.64	4.62	14.45	12.99	5.88	4.85	4.62	0	0
2015Q3	4.71	4.67	14.49	12.79	5.91	4.88	4.65	1	0
2015Q4	4.72	4.69	14.53	12.99	5.91	4.88	4.67	0	0
2016Q1	4.69	4.70	14.57	12.97	5.92	4.88	4.67	0	0
2016Q2	4.74	4.72	14.62	13.07	5.94	4.93	4.68	0	0
2016Q3	4.76	4.74	14.68	12.91	6.04	4.92	4.67	0	0
2016Q4	4.71	4.75	14.70	13.11	6.04	4.89	4.69	0	0
2017Q1	4.70	4.76	14.72	13.02	6.06	4.89	4.65	0	0
2017Q2	4.73	4.77	14.77	13.11	6.06	4.93	4.64	0	0
2017Q3	4.77	4.79	14.81	13.00	6.09	4.94	4.64	0	0
2017Q4	4.74	4.80	14.83	13.17	6.10	4.94	4.63	0	0
2018Q1	4.74	4.81	14.87	13.09	6.12	4.92	4.65	0	0
2018Q2	4.77	4.82	14.95	13.18	6.13	4.95	4.70	0	0
2018Q3	4.80	4.85	14.98	13.07	6.17	4.94	4.76	0	0
2018Q4	4.76	4.86	15.01	13.20	6.19	4.92	4.72	0	0
2019Q1	4.77	4.87	15.03	13.11	6.22	4.94	4.70	0	0
2019Q2	4.83	4.88	15.09	13.19	6.22	4.97	4.70	0	1
2019Q3	4.87	4.90	15.12	13.10	6.29	5.01	4.73	0	1
2019Q4	4.86	4.90	15.14	13.27	6.29	5.03	4.74	0	1
2020Q1	4.86	4.91	15.18	13.15	6.29	5.04	4.79	0	1
2020Q2	4.88	4.92	15.26	13.07	6.29	5.06	4.79	0	1
2020Q3	4.92	4.93	15.31	13.12	6.30	5.10	4.77	0	1
2020Q4	4.90	4.93	15.35	13.26	6.30	5.06	4.77	0	0
2021Q1	4.90	4.94	15.39	13.21	6.31	5.06	4.76	0	0
2021Q2	4.94	4.95	15.46	13.18	6.31	5.10	4.78	0	0
2021Q3	4.96	4.97	15.48	13.16	6.34	5.12	4.78	0	0
2021Q4	4.95	4.99	15.48	13.32	6.36	5.11	4.79	0	0
2022Q1	4.97	5.01	15.49	13.23	6.39	5.14	4.80	0	0
2022Q2	5.01	5.03	15.52	13.27	6.40	5.16	4.84	0	0
2022Q3	5.04	5.06	15.53	13.20	6.45	5.19	4.87	0	0
2022Q4	5.01	5.08	15.56	13.31	6.46	5.17	4.88	0	0
2023Q1	5.04	5.09	15.59	13.26	6.46	5.18	4.88	0	0
2023Q2	5.08	5.11	15.63	13.30	6.48	5.27	4.88	0	0
2023Q3	5.12	5.12	15.67	13.25	6.51	5.25	4.89	0	0
2023Q4	5.06	5.12	15.70	13.36	6.51	5.25	4.89	0	0

Annex II: Variables in Log Levels

	FOOD INDEX	NON-FOOD INDEX	M2	GDP	SWRI	FOOD INDEX INDIA	EXRATE NEPAL	DUMMY EARTHQUAKE	DUMMY COVID_19
2013Q3	4.52	4.55	14.14	12.79	5.74	4.79	4.59	0	0
2013Q4	4.49	4.55	14.18	12.93	5.80	4.75	4.60	0	0
2014Q1	4.52	4.55	14.21	12.88	5.80	4.77	4.57	0	0
2014Q2	4.55	4.56	14.26	13.07	5.80	4.83	4.56	0	0
2014Q3	4.62	4.60	14.29	12.87	5.83	4.83	4.59	0	0
2014Q4	4.58	4.60	14.32	13.05	5.87	4.81	4.62	0	0
2015Q1	4.60	4.60	14.36	12.93	5.87	4.82	4.60	0	0
2015Q2	4.64	4.62	14.45	12.99	5.88	4.85	4.62	0	0
2015Q3	4.71	4.67	14.49	12.79	5.91	4.88	4.65	1	0
2015Q4	4.72	4.69	14.53	12.99	5.91	4.88	4.67	0	0
2016Q1	4.69	4.70	14.57	12.97	5.92	4.88	4.67	0	0
2016Q2	4.74	4.72	14.62	13.07	5.94	4.93	4.68	0	0
2016Q3	4.76	4.74	14.68	12.91	6.04	4.92	4.67	0	0
2016Q4	4.71	4.75	14.70	13.11	6.04	4.89	4.69	0	0
2017Q1	4.70	4.76	14.72	13.02	6.06	4.89	4.65	0	0
2017Q2	4.73	4.77	14.77	13.11	6.06	4.93	4.64	0	0
2017Q3	4.77	4.79	14.81	13.00	6.09	4.94	4.64	0	0
2017Q4	4.74	4.80	14.83	13.17	6.10	4.94	4.63	0	0
2018Q1	4.74	4.81	14.87	13.09	6.12	4.92	4.65	0	0
2018Q2	4.77	4.82	14.95	13.18	6.13	4.95	4.70	0	0
2018Q3	4.80	4.85	14.98	13.07	6.17	4.94	4.76	0	0
2018Q4	4.76	4.86	15.01	13.20	6.19	4.92	4.72	0	0
2019Q1	4.77	4.87	15.03	13.11	6.22	4.94	4.70	0	0
2019Q2	4.83	4.88	15.09	13.19	6.22	4.97	4.70	0	1
2019Q3	4.87	4.90	15.12	13.10	6.29	5.01	4.73	0	1
2019Q4	4.86	4.90	15.14	13.27	6.29	5.03	4.74	0	1
2020Q1	4.86	4.91	15.18	13.15	6.29	5.04	4.79	0	1
2020Q2	4.88	4.92	15.26	13.07	6.29	5.06	4.79	0	1
2020Q3	4.92	4.93	15.31	13.12	6.30	5.10	4.77	0	1
2020Q4	4.90	4.93	15.35	13.26	6.30	5.06	4.77	0	0
2021Q1	4.90	4.94	15.39	13.21	6.31	5.06	4.76	0	0
2021Q2	4.94	4.95	15.46	13.18	6.31	5.10	4.78	0	0
2021Q3	4.96	4.97	15.48	13.16	6.34	5.12	4.78	0	0
2021Q4	4.95	4.99	15.48	13.32	6.36	5.11	4.79	0	0
2022Q1	4.97	5.01	15.49	13.23	6.39	5.14	4.80	0	0
2022Q2	5.01	5.03	15.52	13.27	6.40	5.16	4.84	0	0
2022Q3	5.04	5.06	15.53	13.20	6.45	5.19	4.87	0	0
2022Q4	5.01	5.08	15.56	13.31	6.46	5.17	4.88	0	0
2023Q1	5.04	5.09	15.59	13.26	6.46	5.18	4.88	0	0
2023Q2	5.08	5.11	15.63	13.30	6.48	5.27	4.88	0	0
2023Q3	5.12	5.12	15.67	13.25	6.51	5.25	4.89	0	0
2023Q4	5.06	5.12	15.70	13.36	6.51	5.25	4.89	0	0

CHAPTER 9

INFLATION DYNAMICS IN SRI LANKA: HISTORICAL INSIGHTS OF COMPILATION AND RECENT MONETARY POLICY RESPONSES AND DEVELOPMENTS

By
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1. Introduction

Sri Lanka has come a long way in relation to inflation compilation, considering that work regarding inflation computation began in 1938. Since then, inflation computation and compilation have undergone several changes with the economy using six consumer price indices (CPIs) to measure inflation at a particular point in time since the early 2000s. This highlights the importance of inflation as a key macroeconomic variable. As in other economies, Sri Lanka also uses inflation,

- to compute the Cost of Living Allowance (COLA) in wage agreements;
- to compile real effective exchange rates and thereby measure international price competitiveness;
- as price deflators when computing other macroeconomic variables such as GDP in real terms; and,
- as price deflators to assist planners in calculating future financing requirements.

Despite having compiled different indices with varying coverage, the longest-standing index is the Colombo Consumers' Price Index for which both headline and core are calculated. A more recent addition has been the National Consumers' Price Index.

Following the Central Bank of Sri Lanka's transition to an objective of 'economic and price stability' in 2001, Sri Lanka formally adopted Flexible Inflation Targeting (FIT) in 2023 with price stability as its primary objective under the new Central Bank of Sri Lanka Act No. 16 of 2023. Accordingly, a target of 5% with a +/- 2% target band was stipulated in the Monetary Policy Framework Agreement between the Central Bank of Sri Lanka and the Government of Sri Lanka. In turn, this is expected to further enhance monetary policy credibility and accountability, thereby helping to anchor inflation expectations. It is

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noteworthy to mention here that the stellar single-digit inflation track record of 12 years that was maintained by the Central Bank of Sri Lanka was broken in 2022. Subsequently, inflation skyrocketed to almost 70% in September 2022 with the onset of an unprecedented economic crisis that stemmed from twin deficit legacy issues and several policy missteps on the back of COVID-19. However, since then decisive and swift monetary policy actions by the Central Bank, complemented by a suite of actions from the Government enabled Sri Lanka to transition into a rapid disinflation path that has received much commendation in the global arena. In fact, as of November 2024, Sri Lanka has now seen 3 months of deflation.

In this light, this paper seeks to document the evolution of the inflation compilation process in Sri Lanka, and the different inflation measurements that are currently in use while also highlighting the issues that underlie the CPI compilation process as relevant to Sri Lanka. The latter part of the paper looks at inflation dynamics in light of the recent economic crisis episode and Sri Lanka's formal adoption of a Flexible Inflation Targeting (FIT) regime and the rapid disinflation process that was observed soon thereafter on account of the monetary policy measures that were undertaken. A brief introduction to the most recent development of a Single Policy Rate is also reviewed in the context of Sri Lanka's FIT regime.

2. Evolution of CPI in Sri Lanka

Sri Lanka has a long history concerning CPI compilation with preparatory work for the first CPI having begun as far back as 1938 as documented by Korale (2001). Two CPIs were computed during the period from 1940 to 1952 and these comprised the Colombo Working Class Index (CWCI) and the Estate Labour Index Number (ELIN), with the former being compiled by the Department of Commerce and Industries and the latter being compiled by the Department of Labour. The CWCI was later taken over by the Department of Census and Statistics (DCS) in 1947.

The ELIN was based on the results of a budget survey of plantation workers that was conducted over the third quarter of 1939. The CWCI, however, was based on a household budget survey of 340 households conducted in the Colombo Municipality area spanning the period from November 1938 to April 1939. Accordingly, five separate group indices were compiled for the main groups comprising food, fuel and light, clothing, rent, and the miscellaneous group. A consolidated index was then computed for all items and published monthly.

At the end of 1942, an Official Committee was appointed to study the basis on which the 'dearness allowance' and 'government war bonus' were paid. This Committee recommended that the index weights be revised. Accordingly, the revised weights were used in the computation of the index thereafter until 1952. Between the CWCI and its successors, two notable differences were that the weight for food in the CWCI was lower at 52.4% whereas the weights for house rents were higher at nearly 16%.

Expenditure Group	CWCI 1938		CCPI 1952	
	Expenditure Value	Weight	Expenditure value	Weight
1. Food and Drinks	27.64	52.40	125.17	61.89
2. Liquor, Tobacco and Betel and Arecanuts	3.31	6.27	16.85	8.33
3. Housing	8.42	15.96	11.52	5.7
4. Fuel and Light	3.31	6.27	8.67	4.29
5. Clothing and Footwear	4.41	8.36	19.05	9.42
6. Personal Care and Health Services, Household Goods and Services	4.12	7.81	12.18	6.02
7. Transport and Communication	0.96	1.82	3.97	1.96
8. Miscellaneous	0.58	1.11	4.83	2.39
	52.75	**100.00**	**202.24**	**100.00**

Sources: Korale (2001), Report of the Committee to Revise Cost of Living Index – Sessional Paper XI of 1959, and GCPI Technical Report

2.1 Colombo Consumers' Price Index

The Colombo Consumers' Price Index (CCPI) which replaced the CWCI was based on a family budget survey conducted by the DCS in 1949-50 of 455 working class households in the Colombo Municipality. The expenditure data that was obtained from this survey were revalued at 1952 prices to determine the weights of the new CCPI which came into operation from the beginning of 1953. The index number is computed using the Laspeyres method and has been used since 1953 in wage and allowance determination.

The prices for items that are included in the CCPI are collected by officers of the DCS from seven markets within the Colombo Municipality. Prices are collected four times every month from outlets that are located within each of these market areas, including cooperative stores. Transaction retail prices are collected and test purchases are carried out in order to assess the accuracy and reliability of prices that are collected by price collectors.

In the run-up to 2002, when the CCPI was rebased, there was a lot of controversy due to its outdated base of 1949/50. Due to the use of an outdated basket of goods, there seemed to be two types of computational biases. One such bias was caused by missing values for goods that no longer existed and those caused by quality changes of items in the index over long periods. Due to these shortcomings, the DCS sought to replace the index with the Greater Colombo Consumers' Price Index in 1989 and the CBSL later introduced the Colombo District Consumer Price Index. However, despite its shortcomings, since the beginning of compilation, the CCPI continues to remain the most widely used official measure of consumer price inflation in Sri Lanka.

2.2 Greater Colombo Consumers' Price Index

The Greater Colombo Consumers' Price Index (GCPI) was introduced in 1989 based on the results of the nationwide Labour Force and Socio-Economic Survey (LF and SES) which was conducted in 1985-86. The survey gathered data on household income and expenditure as well as on employment and unemployment in 12 monthly rounds, thereby enabling it to account for variations in household consumption.

The survey sampled 25,000 households nationally and over 1,000 sampled households were from the Greater Colombo area. Accordingly, this was considered sufficient to derive weights for the construction of a CPI.

Compared to the CPI, upon its introduction in 1989, the GCPI was considered to be a more realistic indicator of the general level of retail prices due its weights being more up-to-date and its wider item and geographical coverage (Central Bank of Sri Lanka, 1993). The coverage of items comprised 8 major groups that covered 304 consumer commodities as price collection items.

However, the GCPI came under the criticism that it was based on LF and SES 1985/86 which was a large-scale multi-subject survey that was not specifically designed and conducted as a family budget survey (Korale, 2001).

2.3 Colombo District Consumer Price Index

The Central Bank of Sri Lanka (CBSL) introduced and released the Colombo District Consumer Price Index (CDCPI) in 1998. While weights were derived from the Consumer Finance and Socio-Economic Survey 1996/97, a unique feature of the CDCPI was that the geographical coverage included the rural sector for the first time. The reference period of the index was October 1996 – September 1997 and about 200 items were included in the market basket. School teachers served as price data collectors, collecting data from retail outlets.

It is noteworthy to mention that the GCPI and the CDCPI co-existed resulting in two authorities releasing two inflation data points, although with some principal differences.

2.4 Other Regional Price Indices

From 1999, the CBSL also compiled three monthly Regional Consumer Price Indices, namely, the Anuradhapura Consumer Price Index (APCPI), Matale Consumer Price Index (MLCPI), and the Matara Consumer Price Index (MRCPI). Although these indices were not been published monthly, they have been covered to some extent in the Annual Reports of the CBSL.

To increase geographical and income group coverage on an experimental basis (previously, all indices only covered consumption baskets of low-income households in the respective regions), the CBSL in 1999, developed and compiled a Western Province Consumer Price Index (WPCPI) which covered the lowest 65% of households classified by income. This index was used entirely for internal analysis and was not published.

2.5 National Consumer Price Index

The National Consumer Price Index (NCPI) was first released in November 2015 compiling prices collected for all of the nine provinces to create an index that measures price changes for the entire country. It is released with a time lag of 21 days. The first NCPI 2013=100 was based on data from the Household Income and Expenditure Survey (HIES) 2012/13. Accordingly, provincial weights are assigned based on consumption expenditures within the province in proportion to the expenditure in the whole country for each item.

3. Contemporary Status of the Consumer Price Indices in Sri Lanka

With the shift in the policy direction of the CBSL in 2001 to concentrate on its core objectives, one of which was price stability (Central Bank of Sri Lanka, 2002), there began discussions on the compilation of an overall measure of inflation for the country considering the lack of coverage of the middle class in the existing CPIs, among other issues. In April 2001, the Ministry of Finance established a national committee to conceptualise and develop a countrywide CPI. The National Committee unanimously agreed that the compilation of a countrywide consumer price index would be the responsibility of the National Statistical Agency, the DCS, rather than the CBSL. The decision set out to enhance the credibility of the index with the public. The underpinning rationale was that the CBSL would be responsible for monetary policy implementation towards the target of price stability while an independent institution, the DCS, would be responsible for measuring the outcome of those policies in attaining the target. Accordingly, the CBSL ceased the compilation of all price indices.

3.1 Colombo Consumer Price Index

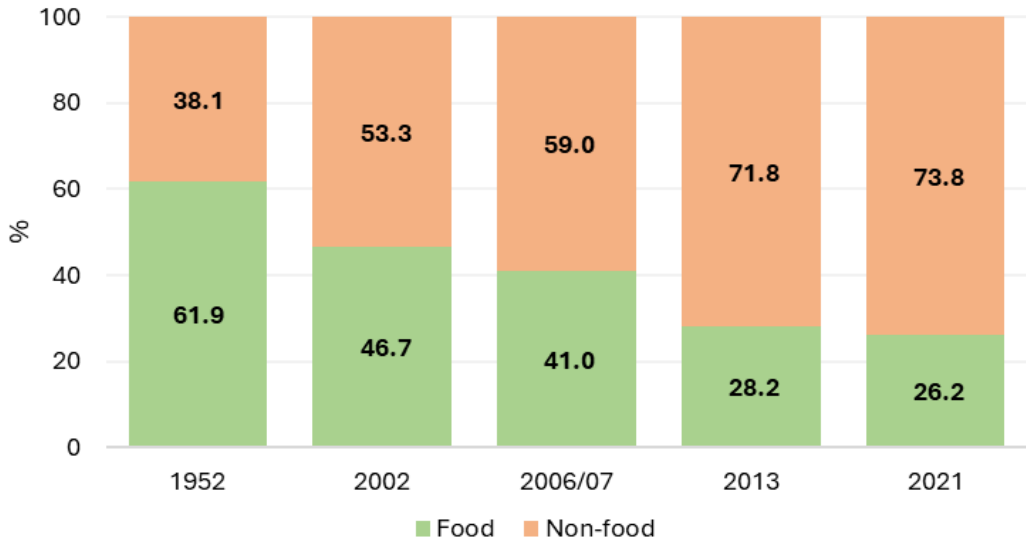
The base year of the first CCPI was 1952 with the basket of goods being selected based on consumption and expenditure patterns identified from the Colombo Family Budget Survey 1949/50. Following this, the CCPI was rebased to 2002, after which there have been more frequent revisions with the reference year being shifted to 2006/07, 2013 and the current one of 2021. Each of these rebasing exercises has been based on the findings of the HIES conducted during the respective periods.

Over the years with each round of rebasing, there have been several key improvements and changes that have been introduced. The most significant change in the indices over time has been the transformation in the shares of food and non-food expenditure in the consumption basket. While the share of expenditure on food stood at 61.95% in CCPI 1952 = 100, this was drastically reduced to 26.23% in CCPI 2021 = 100.

The price reference period for which prices are used as denominators in the index calculation was an average of the two years from January 2018 to December 2019 as 2019 was not considered normal due to certain unusual events during the period.

The CCPI comprises 426 representative items across 105 sub-classes of goods and services which are further categorised into 12 groups using the internationally recommended Classification of Individual Consumption according to Purpose (COICOP). The expenditure level on the basket of goods and services in the CCPI 2021=100 stood at Rs. 91, 880.34 which was 52.21% higher than the expenditure level of Rs. 60,364.73 seen in the previous base year of 2013. Further, the value of one index point stood at Rs. 918.80.

Decomposition of CCPI Baskets (in base years)



Source: Department of Census and Statistics.

3.2 National Consumer Price Index

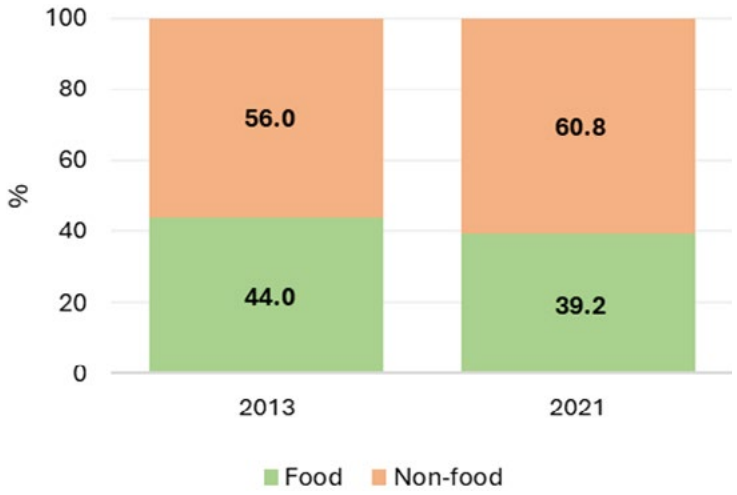
Subsequent to its inception in 2013, the reference period of the NCPI was updated to 2021=100 starting from January 2023. Accordingly, it is based on data from the HIES conducted in 2019. The national average monthly value of the base period expenditure level on the basket of goods and services in the NCPI (2021=100) stood at Rs. 50,728.60 which was 57.82% higher than the index reference period expenditure level of Rs. 32,142.69 in the previous index (2013=100). Further, the value of one index point stood at Rs. 507.29.

As seen for the CCPI, the price reference period was an average of the two years from January 2018 to December 2019.

It is also to be noted that NCPI has a larger consumption basket than CCPI with almost 485 representative items across 105 sub-classes of goods and services which are further categorised into 12 groups using the internationally recommended Classification

of Individual Consumption according to Purpose (COICOP). The share of the food category between the time of inception, i.e., NCPI 2013 = 100 and NCPI 2021=100 has come down from 55.96% to 39.22%, respectively.

Decomposition of NCPI Baskets (in base years)



Source: Department of Census and Statistics.

4. Calculation of the CPIs[2]

Currently, the CPIs are calculated in two steps. As the first step, elementary indices are calculated for each of the elementary aggregates followed by the calculation of higher-level indices using the weighted averages of the elementary price indexes. Elementary indices are compiled using the geometric mean or Jevons formula.

The Jevons price index is defined as the ratio of the unweighted geometric mean prices, for the two periods, 0 and t, to be compared:

$$I_J^{0:t} = \frac{\prod(p_i^t)^{\frac{1}{n}}}{\prod(p_i^0)^{\frac{1}{n}}}$$

The DCS uses the chained Jevons which calculates long-term price change by chaining together short-term (or month-on-month) price changes. Accordingly, the formula for the chained Jevons is as follows:

$$I_{Jc}^{0:t} = \prod(\frac{p_i^t}{p_i^0})^{\frac{1}{n}} = \frac{\prod(p_i^1)^{\frac{1}{n}}}{\prod(p_i^0)^{\frac{1}{n}}} \frac{\prod(p_i^2)^{\frac{1}{n}}}{\prod(p_i^1)^{\frac{1}{n}}} \dots \dots \frac{\prod(p_i^t)^{\frac{1}{n}}}{\prod(p_i^{t-1})^{\frac{1}{n}}} = \frac{\prod(p_i^t)^{\frac{1}{n}}}{\prod(p_i^0)^{\frac{1}{n}}} = \prod(\frac{p_i^t}{p_i^0})^{\frac{1}{n}}$$

2. Department of Census and Statistics, A Briefing on the Rebased Colombo Consumer Price Index (Base 2021=100) for Sri Lanka Department of Census and Statistics. Available at: https://www.statistics.gov.lk/InflationAndPrices/StaticalInformation/MonthlyCCPI/Techinical_Note

The current-period estimate of the cost of base period spending assigned to the item is derived by multiplying this short-term ratio with the estimated cost of base period spending of an item in the previous month. The CPI is then the sum of the current period's estimated cost of base period spending divided by the spending in the fixed base period.

The calculation of upper-level indices is done through a Modified Young Formula which is as follows:

$$I_{MY}^{0:t} = \sum w_j^b I_j^{0:t-1} I_j^{t-1:t} \quad , \quad \sum w_j^b = 1$$

The short-term formula, i.e., the Modified Young, weights each short-term price relative to its previous expenditure share. In turn, the previous period's expenditure share is equivalent to the base period value share, updated for price change to the previous period. In this manner, a better representation of the dynamic nature of the weighting structure is seen.

A key advantage of the Modified Young formulation is that it allows for the introduction of new transactions without resorting to the imputation of base period prices. Also, when two successive prices for the replacement transaction are available, it can be used in place of any transaction that is no longer available. Further, if a price is missing, the short-term price change of similar items can be used for the purpose of imputation. In addition, being a short-term formulation, the Modified Young formula allows flexibility to deal with changes in quality.

First, basic price indexes are created for small groups of items. Then, these are combined using weighted averages to form higher-level indices.

For the basic indices, a method called the Jevons formula, which uses geometric averages, is often used when there are no specific data on how much of each item people buy. This method compares average prices from two different times.

For long-term price changes, the Jevons formula can be used directly or by linking together short-term price changes (month to month). The formula calculates the price change by comparing current prices to prices from a reference period, adjusting for any changes in spending patterns.

For higher-level indices, another formula called the Young formula is used, but with some adjustments. The Modified Young formula is preferred because it adapts better to changes in spending patterns over time and makes it easier to handle missing data or new items. This method also helps identify unusual price changes more easily.

4.1 Importance of Core Inflation

Literature highlights that core inflation can be a good indicator of current and future trends in inflation. Also known as underlying inflation, it helps measure price trends by excluding disturbances stemming from temporary shocks. Therefore, core inflation typically shows changes in prices that are driven by economic fundamentals, such as demand pressures, permanent shifts in relative prices, or changes in inflation expectations.

In Sri Lanka, DCS calculates core inflation for both CCPI and NCPI. Core inflation across both of these CPIs excludes prices of fresh foods, energy and transport. In this manner, the impacts of temporary supply shocks are excluded, e.g., climate factors or seasonal patterns which tend to impact the aforementioned items that are excluded from core inflation.

5. Current Issues in Compilation of CPIs

Currently, prices for the compilation of both CPIs are concentrated across 10 markets and fairs (CCPI) or 3 price collecting outlets in each district town. However, it is to be noted that socioeconomic or lifestyle changes may have led to increasing purchases from other outlets, such as supermarkets or local retail shops. Random observations of prices show that there are significant variations in prices across these outlets when compared to traditional price collection points.

There is increasing concern about the consumption basket as well and its true representativeness. For instance, notably the monthly expenditure amount for pre-school fees which stood at Rs. 251 in 2019, has increased to Rs. 348 in 2023 while the monthly expenditure on coconuts is over 5 times higher. In addition, several items that have become part of daily consumption are yet to be captured, for e.g., baby care items such as diapers which are a significant portion of expenditure but remain outside the ambit of the formal consumption basket. Another notable concern is that the basket of goods and services used for inflation compilation is based on the Household Income and Expenditure Survey of 2019. Conducted prior to the onset of COVID-19, this may survey may now be considered to be outdated due to the significant economic shifts brought about by the pandemic and the subsequent crisis. Accordingly, six years later, it is debatable whether expenditure patterns that are captured in the inflation compilation process accurately reflect contemporary consumer behavior and trends.

Prices of certain items under the main categories of Education and Communication are collected annually through surveys, unless otherwise ad hoc surveys are conducted if there are notable changes to prices (for e.g., from tax or other policy changes). Therefore, prices of such items in both CPIs will not be updated until the annual surveys are done, although there may be occurrences where actual prices change more frequently.

The current CPI baskets do not have a breakdown of categories/ items to identify imported inflation. Having the capability to identify imported inflation from the CPIs is absolutely important for emerging market economies like Sri Lanka, given the fact that any substantial changes in the exchange rate could have an impact on inflation.

6. Recent Inflation Trends in Sri Lanka

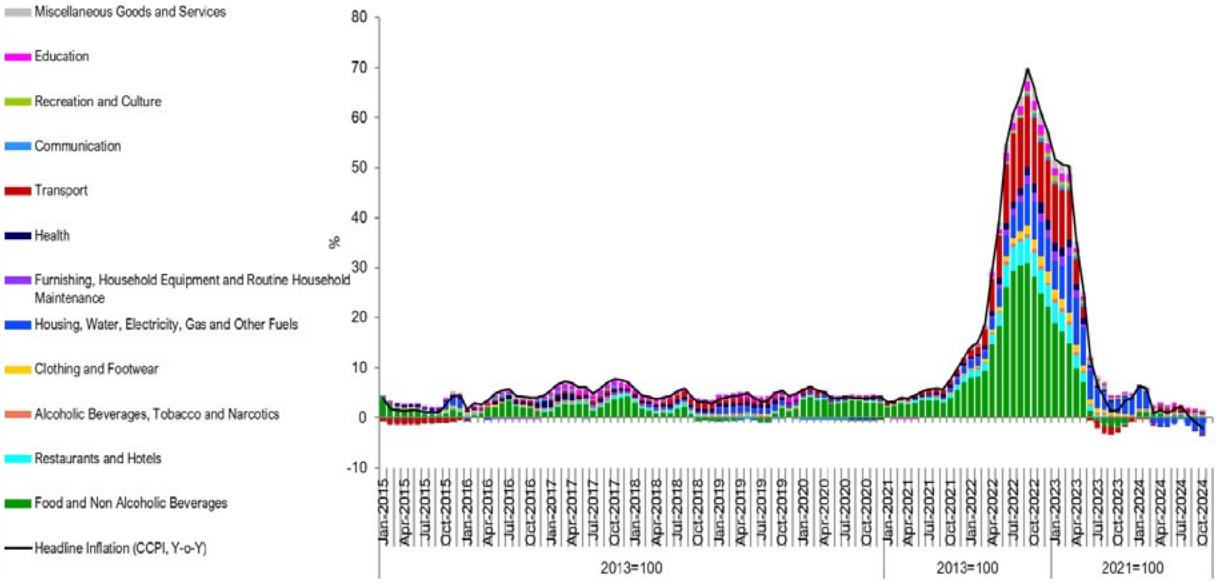
6.1 Inflation Across Major Components

As per CCPI, the major components/ categories of inflation, in the order of the share of the total CCPI basket, are;

1. Housing, Water, Electricity, Gas and Other Fuels (31.6%)
2. Food and Non Alcoholic Beverages (26.2%)
3. Transport (12.5%)

These three categories account for almost 70% of the overall inflation basket. Accordingly, inflation in Sri Lanka is highly susceptible to changes in the prices of food, energy and transport, utilities as well as rent.

Contribution to Headline Inflation (CCPI)



* This chart is produced using a constructed (backcast) series based on CCPI baskets with base years 2013 and 2021.

Source: Department of Census and Statistics, CBSL Calculations.

It is noteworthy to mention that until late 2021, Sri Lanka had consistently dabbled with the implementation of a cost-reflective pricing formula for petroleum products. Accordingly, price revisions to petroleum products were largely of an ad-hoc nature with long periods of time where there was no revision at all. Electricity tariffs in Sri Lanka had also not been revised since 2014 and were revised upward by 75% in August 2022. Accordingly, energy prices emerged as a driver of inflation from late 2021 onwards with its contribution growing significantly in 2022, especially with the implementation of a cost-reflective pricing formula for the revision of prices of petroleum products on a monthly basis and a regular tariff revision mechanism for electricity wherein there have been 6 revisions since 2022, of which the first two revisions took place in August 2022 and February 2023 and entailed upward revisions of 75% and 66%, respectively. Needless to say, these upward price pressures in the energy sector are not only a correction of the subsidised nature of prices prior to 2021 but also a translation of price movements in the global market as Sri Lanka has a certain level of reliance on fuel based electricity generation due to the seasonal nature of hydro-based power.

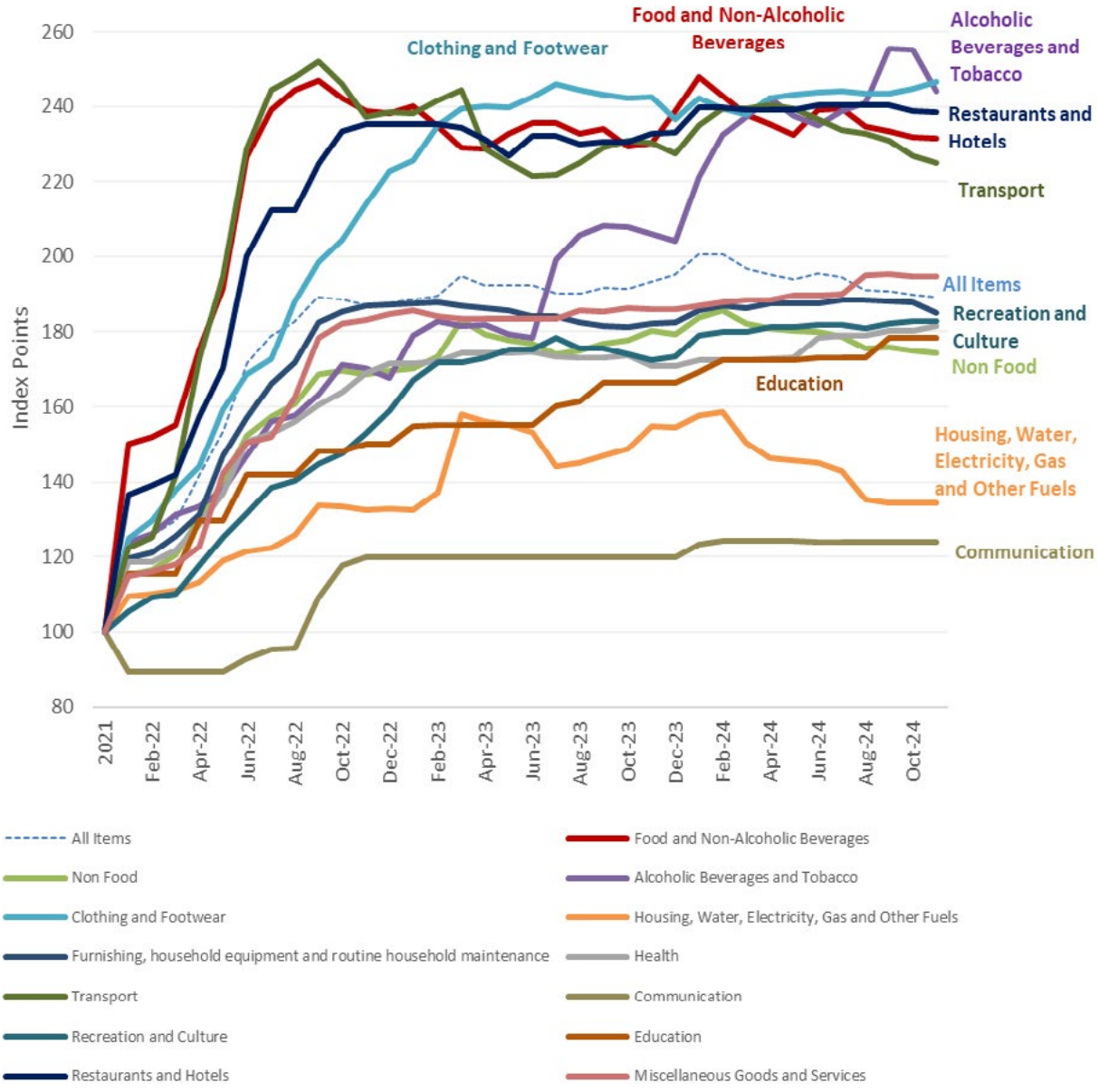
In May 2021, there was an outright ban on the use of chemical fertilisers for agriculture and a push to adopt organic agriculture. Due to the lack of preparedness of the sector for such a sudden transition, this significantly affected agriculture production in the period thereafter causing a sharp escalation in food prices. Further, with the onset of the crisis in 2022, there were significant shortages of fuel which also weighed heavily on the price escalations due to disruptions in supply chains.

The sharp rise in prices in these categories, in turn, had obvious second-round effects which saw escalations across other categories as well.

However, subsequent to the peak in 2022, the tight monetary and fiscal measures that were in place alongside the normalisation of domestic supply side conditions, moderation of global commodity prices, the strengthening of the Sri Lanka rupee and the favourable statistical base effect created by large month-on-month increases in prices seen in 2022, resulted in the year-on-year headline inflation, measured by the CCPI decelerating to 1.3% in September 2023, i.e., exactly a year after. In fact, the 'food items' and 'transport sector' categories which were two of the largest contributors to the high inflation episode recorded deflation during several months in 2023.

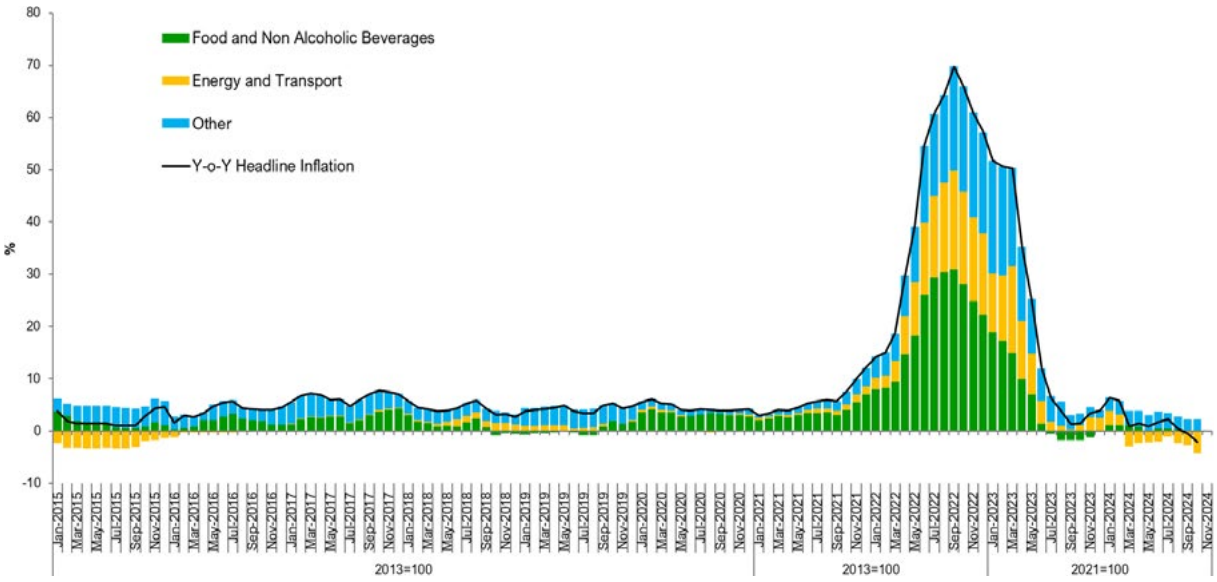
Although there was a temporary surge in inflation in 2024 due to an increase in the Value Added Tax (VAT) rate and the removal of certain exemptions, reductions of electricity tariffs and several subsequent responsive price reductions and moderation in food prices led inflation to fall throughout 2024 (Central Bank of Sri Lanka, 2024).

Movements in the CCPI (2021=100) - Major Categories



Source: Department of Census and Statistics.

Contribution to Headline Inflation (CCPI, 2013=100 and 2021=100)



* This chart is produced using a constructed (backcast) series based on CCPI baskets with base years 2013 and 2021.
Source: Department of Census and Statistics, CBSL Calculations.

6.2 Imported Inflation

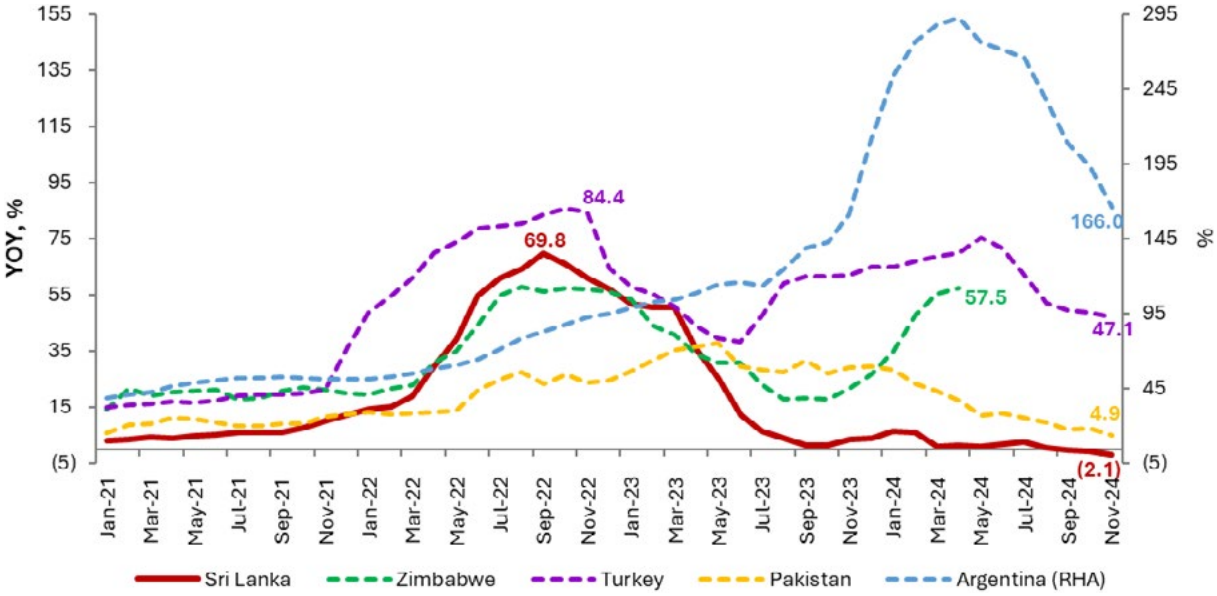
In January 2001, Sri Lanka adopted a flexible exchange rate regime and thereby abandoning the fixed exchange rate system wherein the Sri Lankan Rupee (LKR) was pegged to the United States Dollar (USD). Over the years, with the gradual transition to an enhanced monetary policy framework which preluded the adoption of FIT, despite the presence of a flexible exchange rate regime, the exchange rate has seen several episodes of significant and undue volatilities driven by several inconsistent policies in the pre-crisis period. Several studies such as Ratnasiri (2011), Bandara (2011), Jayawardana & Jayasinghe (2016) all highlight that the exchange rate has been one of the key determinants of inflation. Shyalini (2019) estimates that inflation rises by 4.64% for every one percent increase in imports. Accordingly, the extent of 'imported inflation' has been a subject of concern over the years, also with Sri Lanka being reliant on imports for several items, including fuel, fertiliser and several other food commodities as well, such as milk powder, wheat flour, eggs and even rice, at times. Further, the export industry, such as textiles and garments, also has a high reliance on imported goods.

Imported inflation stems from prices of imported goods which exert an influence on inflation, i.e., domestic price levels. This could either be through imported consumption goods that are included in the CPI or through imported 'inputs' used for domestic production which have possible second-round effects on the CPI. Although the current CCPI basket does not contain a breakdown of imported and non-imported items, to assess the likely impact of imported items on inflation, an approximate analysis based on the

CBSL staff judgments and assumptions on import weights of each expenditure item of the CCPI basket was conducted. Accordingly, as per the staff judgement, expenditure on imported items has consistently been in the range of around 25-35% in the CCPI basket which highlights the inflation vulnerabilities that the country faces due to its reliance on imports with many being essentials which exert second and third round effects on inflation.

6.3 Monetary Response to Recent High Inflation Episode

Headline Inflation of Selected Economies



Source: Respective Statistical Agencies.

As highlighted before, the conscientious maneuvering by the CBSL, helped keep Sri Lanka's inflation checked in at single digit levels for over 12 consecutive years. Policy missteps in the wake of COVID-19 caused inflation to spike sharply in 2022. However, swift and substantial policy responses contributed to effectively bringing down inflation at a commendable pace and effectively keeping it reined in as the country begins its recovery journey.

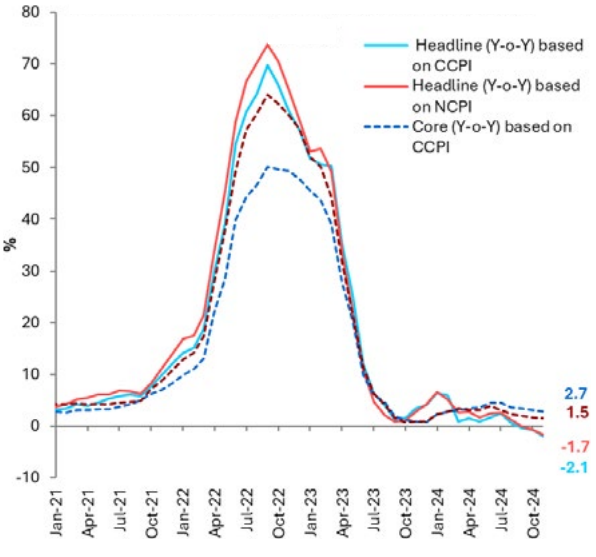
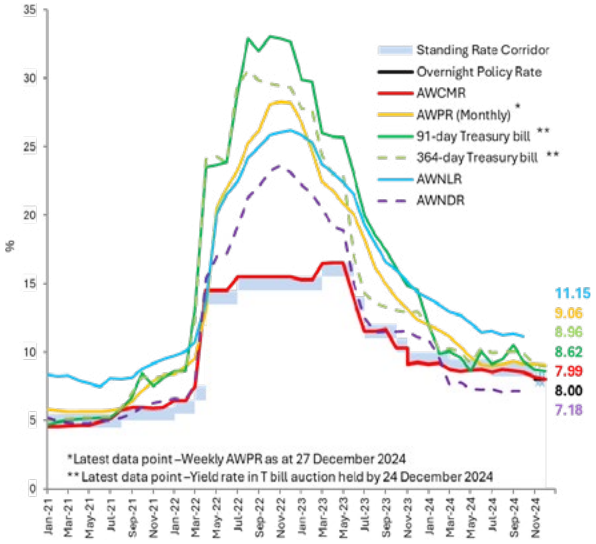
In particular, foreseeing the possibility of inflation accelerating and breaching into double-digits, the CBSL commenced tightening its monetary policy stance in August 2021 by 50 basis points, and then followed it up by further raising policy interest rates in January and March 2022 by a cumulative total of 150 basis points. Accompanied by the policy rate increases, a measured adjustment was also allowed in the exchange rate wherein it depreciated by over 40%. In addition to the sharp depreciation of the Sri Lankan rupee, the extended period of monetary accommodation that was in place since the onset of the

COVID-19 pandemic was viewed to create significant upside risks to the inflation outlook thereby leading the Central Bank to raise policy interest rates substantially by 700 basis points (i.e., 7 percentage points) in April 2022 followed by a further 100 basis points (i.e., 1 percentage point) increase in July 2022. This rapid tightening of monetary conditions has often been compared to 'hitting the brakes' on an economy that was on a downhill path thereby trying to somewhat minimise the impact of the ensuing inevitable crash. Hence, it sought to arrest the build-up of demand-driven inflationary pressures while managing adverse inflationary expectations and also easing pressures on the external sector. Maximum interest rate caps that were imposed on selected lending products, including pawning, credit cards and pre-arranged temporary overdrafts were removed enabling the effective tightening of monetary conditions. In order to support this tight monetary policy stance, overnight liquidity in the domestic money market was also maintained at negative levels during 2022. In this regard, it is important to note that market interest rose significantly with most reaching historically high levels which were also disproportionate to the rise in policy interest rates. This was primarily driven by the influence of high-risk premia that was attached to government securities due to uncertainties associated with debt restructuring, following the announcement of the debt standstill by the Government in April 2022. With early signs of the successful slowing of inflation being evident, the Central Bank communicated to the markets the same and the need for excessive interest rates, particularly lending interest rates to come down. Accordingly, interest rates commenced moderating from late 2022 onwards. However, credit flows to the private sector continued to moderate with outstanding credit to the private sector contracting in absolute terms, consecutively, between June 2022 till May 2023 (Central Bank of Sri Lanka, 2023).

While the tight monetary policy stance continued in 2023 to keep inflation and inflation expectations reined in, the Central Bank provided liquidity to contain any excessive pressures on market interest rates due to the large deficit levels in the domestic money market in 2022. Further in order to promote activity in the domestic money market, the Central Bank also implemented regulatory actions limiting access to the standing facilities of the Central Bank effective mid-January 2023, thereby reducing the overdependence of Licensed Commercial Banks (LCBs) on standing facilities. With the finalisation of the Extended Fund Facility arrangement with the International Monetary Fund (IMF-EFF), there was a gradual turnaround in yields on government securities and other retail market interests to align with policy interest rates. As stability was gradually restored and inflationary pressures contained, the Central Bank commenced easing its monetary policy stance from June 2023 onwards, where policy interest rates were reduced by a total of 650 basis points (i.e., 6.5 percentage points) during the latter half of 2023 (Central Bank of Sri Lanka, 2024).

Monetary policy continued to be relaxed in 2024 in the midst of subdued inflationary pressures, favourable near-term inflation dynamics, well-anchored inflation expectations, as well as the absence of excessive external sector pressures (Central Bank of Sri Lanka, 2024). Accordingly, in 2024, policy interest rates were further reduced by a total of around 125 basis points[3] as inflation fell to negative levels for the first time in September 2024 and stayed negative through end 2024.

Chart 4: Co-movement of Inflation Indicators

Movements in Headline and Core Inflation (y-o-y)	Movements in Selected Market Interest Rates
	
	AWCMR: Average Weighted Call Money Rate AWPR: Average Weighted Prime Lending Rate

Sources: Department of Census and Statistics and Central Bank of Sri Lanka

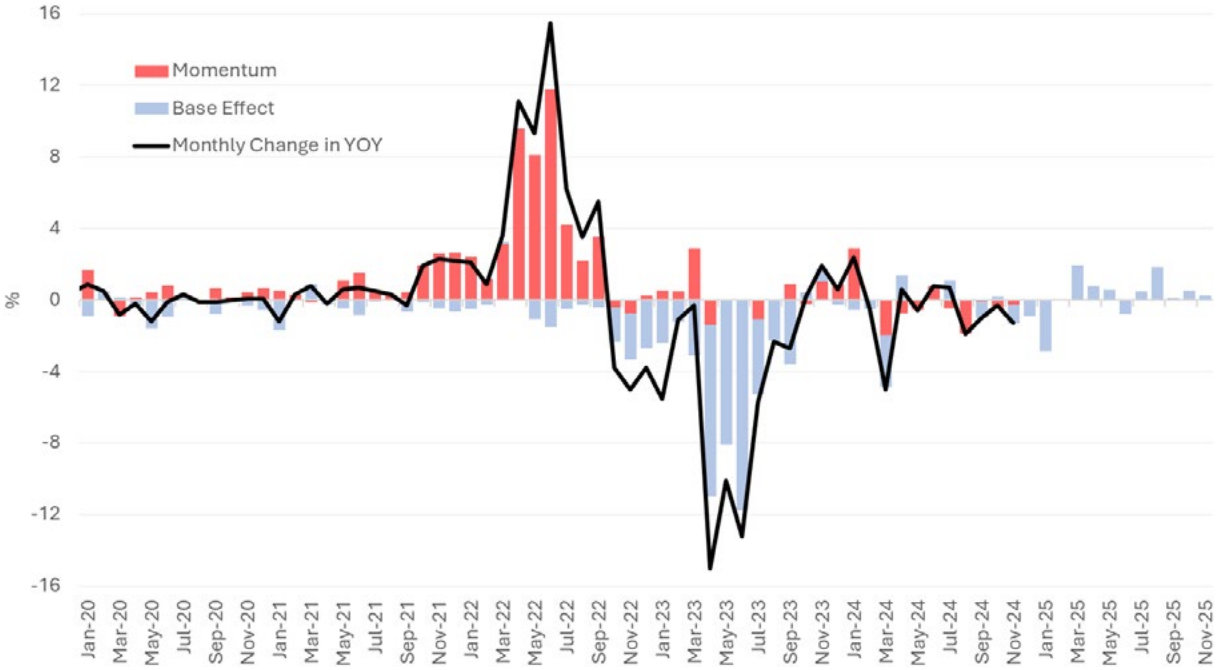
6.4 The Momentum and Base Effects

An alternative method of analysing inflation developments is by observing the momentum of inflation and the effect of the base. The month-on-month measure of inflation provides an assessment of price movements in the most recent month under consideration, compared to the preceding month. Hence, this measure is also referred to as the 'price momentum' or the 'momentum of inflation'. Inflation measured by the year-on-year change in a consumer price index, however, depends on two factors: the price movements in the current month and the price movements recorded one year ago. The latter is referred to as the 'base effect', which is the contribution to the change in the year-on-year inflation that stems from the month-on-month inflation in the base

3. Policy interest rates were reduced by a total of 75 basis points in March and July 2024 under the dual policy interest rate system, and with the move towards a single policy interest rate regime, the effective reduction in the policy interest rate was around 50 basis points.

period (i.e., one year ago). Furthermore, the change in year-on-year inflation can be approximated by the month-on-month inflation in the current period (momentum effect), less the month-on-month inflation twelve months ago (base effect). In the case of Sri Lanka, the momentum of inflation rose significantly in early 2022, before moderating to around the historical average towards late 2022, signaling the easing of inflation pressures in the economy. Along with that, as the effect of the base kicked in, year-on-year inflation moderated to single-digit levels during 2023 and early 2024. Thereafter, as domestic prices declined following the downward adjustments to fuel, gas and electricity tariffs as well as the intermittent declines in food prices, the momentum of inflation was mostly negative through most months of 2024 causing deflation in the latter part of 2024.

Momentum and Base Effect (CCPI)*



* This chart is produced using a constructed (backcast) series based on CCPI baskets with base years 2013 and 2021.
Source: CBSL Staff Calculations.

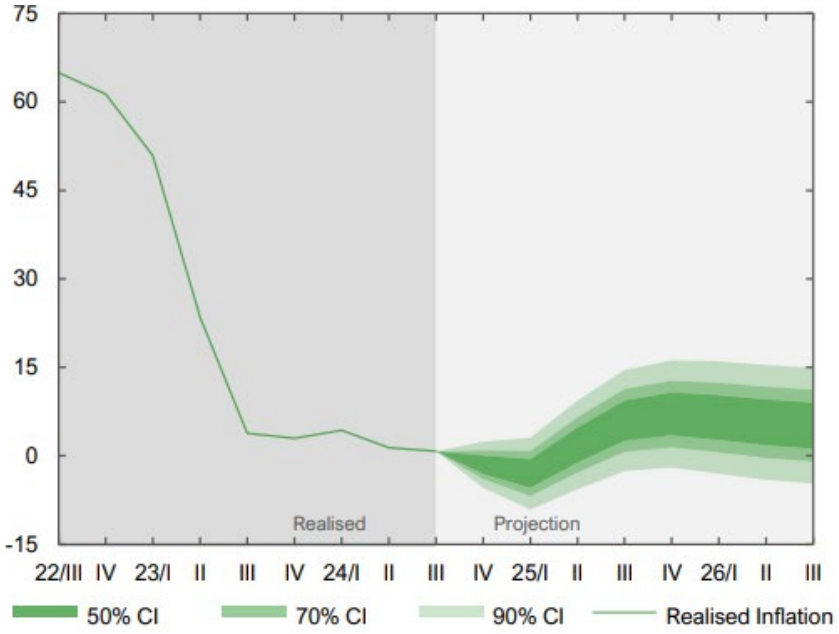
7. Sri Lanka's Transition to Flexible Inflation Targeting (FIT)

Having operated within a monetary targeting framework for nearly three decades and observing the need to directly target inflation given the weakening relationship between money and inflation, the Central Bank of Sri Lanka embarked on transitioning to a FIT framework, initially by adopting a framework that had features of both monetary targeting and FIT. Subsequently, with the success achieved in stabilising inflation, CBSL adopted FIT in 2020 as its monetary policy framework. Accordingly, CBSL aims to maintain headline inflation at the targeted levels as determined in the Monetary Policy Framework Agreement (currently at 5%), while supporting economic growth to reach its potential.

Also, as part of this process, CBSL has taken steps to improve its transparency and accountability by way of publishing inflation projections for the medium-term.

Headline Inflation Projections*: (Quarterly, CCPI, Y-o-Y, %)

Based on the Projections during the November 2024 Monetary Policy Round



Source: CBSL Staff Projections.

* Realised data up to Q4 2022 shown in the fan chart are based on the CCPI (2013=100, seasonally adjusted), while date after this period are based on the CCPI (2021=100, seasonally adjusted).

Note: The fan chart illustrates the uncertainty surrounding the baseline projection path using confidence bands of gradually fading colours. The confidence intervals (CI) shown on the chart indicate the ranges of values within which inflation may fluctuate over the medium term. For example, the thick green shaded area represents the 50 per cent confidence interval, implying that there is a 50 per cent probability that the actual inflation outcome will be within this interval. The confidence bands show the increasing uncertainty in forecasting inflation over a longer horizon.

Notation: A forecast is neither a promise nor a commitment.

A significant recent advancement introduced by the Central Bank in its monetary policymaking has been the implementation of the single policy interest rate mechanism, where the Overnight Policy Rate (OPR) serves as the policy interest rate that signals the Central Bank's monetary policy stance. This enhancement will not only enhance the transparency and clarity of monetary policy under a flexible inflation targeting framework, but will also strengthen its transmission to the broader economy. Prior to this, the Central Bank had used its policy instruments to guide short-term interest rates, particularly the average weighted call money rate (AWCMR) as the operating target.

The gradual transition towards adopting a flexible inflation targeting (FIT) framework required the Central Bank to have an inflation target as a nominal anchor. For this purpose, the Central Bank conducted an extensive analysis to determine the choice of the inflation target, a detailed analysis of which was published in 2018 (Central Bank of Sri Lanka, 2020). In summary, the Central Bank chose an urban price index, i.e., the Colombo Consumer Price Index (CCPI) over a national consumer price index (NCPI) as an urban price index provides a better reflection of price trends in the market as prices in non-urban areas may be influenced by lifestyle preferences and consumption patterns. Moreover, since NCPI contains a larger share of food items compared to CCPI, its susceptibility to supply shocks remains high, thereby increasing volatility and a weaker reflection of demand pressures on prices. Given that both CCPI and NCPI display similar trends in terms of inflation, and the delay in publishing NCPI (lag of 21 days) compared to CCPI, which is published at the end of the respective month, the Central Bank observes greater benefits from choosing CCPI as the appropriate price index to measure inflation against the target.

In terms of the type of inflation, the Central Bank has opted for headline inflation over core given that the former is an easy-to-understand metric of inflation, covers prices of goods and services related to fresh foods, energy and transport, which are key expenses borne by households and that headline inflation remains a more powerful communication device that helps anchor inflation expectations, which is useful for forward-looking monetary policy formulation under FIT.

As for the type of inflation target, the Central Bank has a point target of 5%, calculated based on the CCPI-based quarterly headline inflation rate. This rate is jointly determined by the Central Bank and the Government and formalised by signing a Monetary Policy Framework Agreement (MPFA), which is gazetted to enhance transparency and accountability. That said, for the purpose of measuring a target breach, a symmetric margin of ±2 percentage points is agreed upon in the MPFA, and if the Central Bank fails to meet the inflation target by the said margin for two consecutive quarters, the Central Bank will have to submit a report to the Parliament through the Minister of Finance citing the reasons for the breach, remedial measures taken to bring inflation back to the target and the estimated time it is likely to get inflation to the targeted levels. This report shall also be made available to the public.

8. Conclusion

Sri Lanka has a longstanding history in relation to the compilation of price indices, having experimented with various approaches before adopting the CCPI and NCPI. The CCPI, with its longer history, offers a clear advantage, while the NCPI, being a broader counterpart provides some insights into regional variations. Going forward, as the dataset expands, further analyses regarding the movements in NCPI and its relationship with other key macroeconomic variables may support its integration into mainstream policymaking.

In addition to its expertise in index compilation, Sri Lanka has a strong history of prioritising inflation as a critical macroeconomic indicator. The CBSL has focused on establishing economic and price stability even prior to the formal consideration and even adoption of an inflation targeting framework, thereby establishing a robust macroeconomic foundation. While the recent high inflation episode stemmed from the 'twin deficit legacy' and several policy missteps, the CBSL's experience in managing inflation combined with its commitment and that of the Government to curbing inflation has been instrumental in the rapid reversal of inflation trends and the anchoring of inflation expectations. Sri Lanka has received much acclaim for the progress that it has made in this regard and therefore, on the macroeconomic stability front, compared to other peers who continue to grapple with high inflation.

Despite the deflation phenomenon that has been observed in late 2024 and its anticipated continuation into early 2025, with the easing of monetary policy and the renewed sense of macroeconomic and political stability, it is expected that economic activity and demand will pick up in the economy. This recovery will likely guide inflation back towards the target of 5%. The FIT framework, institutionalised under the Central Bank of Sri Lanka Act No. 16 of 2023 is expected to support the Sri Lankan economy's advancement along a positive economic trajectory. By fostering a low inflation environment, the framework aims to enable Sri Lanka to achieve its medium-term economic potential.

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